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Chicago, July 10, 1926 (Issued Every Other Week) Volume XXIX, No. 14

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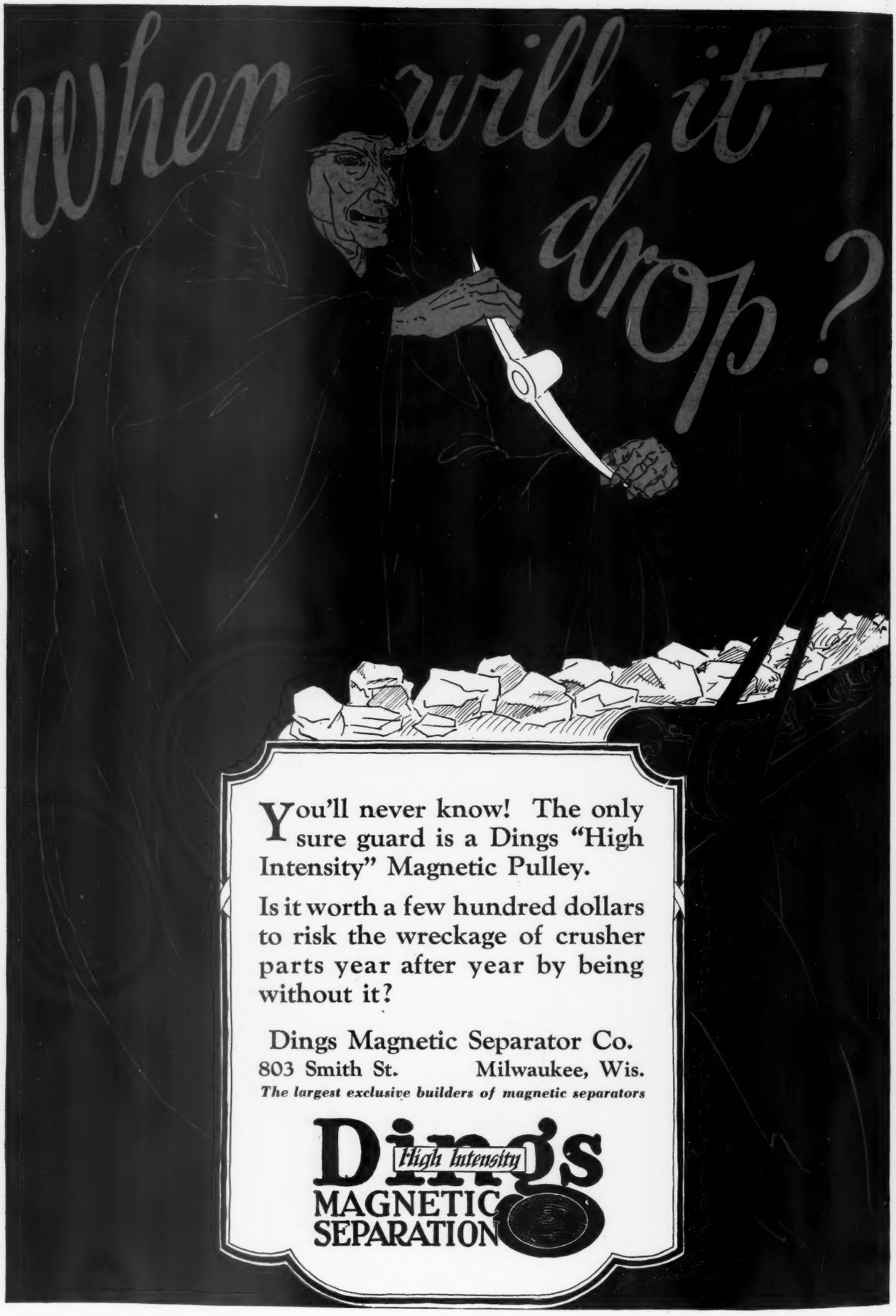
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Rock Products

CEMENT and ENGINEERING NEWS

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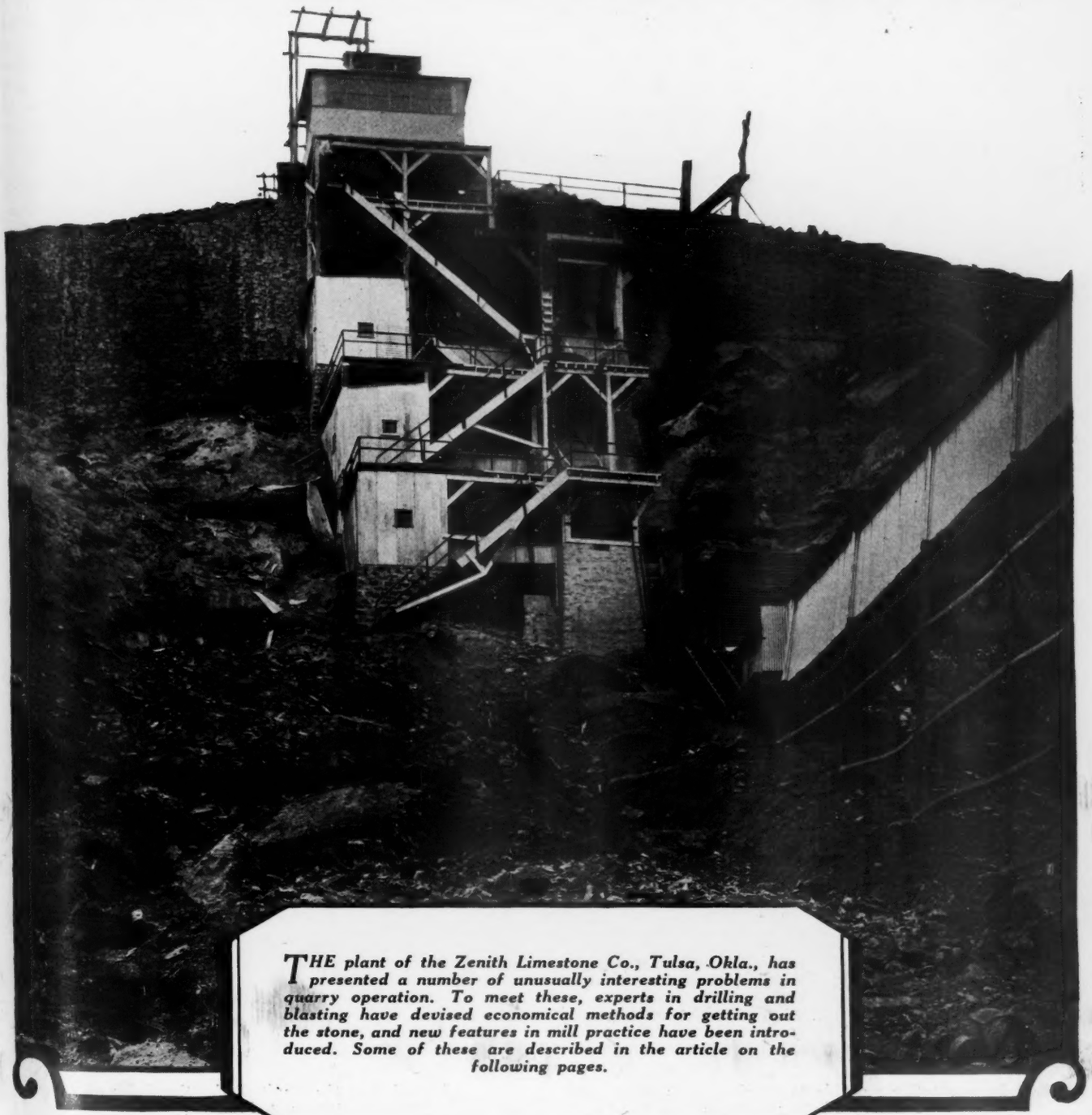


THE plant of the Zenith Limestone Co., Tulsa, Okla., has presented a number of unusually interesting problems in quarry operation. To meet these, experts in drilling and blasting have devised economical methods for getting out the stone, and new features in mill practice have been introduced. Some of these are described in the article on the following pages.

How a Stone Quarry Faced Its Problems and Found a Way Out

Illuminating Story of How Things Are Done at Plant of Zenith Limestone Co., Tulsa, Okla.

THE Zenith Limestone Co. began operations at its quarry and plant near Tulsa, Okla., about two years ago. Both the quarry and the crushing plant have presented problems unlike those usually found in crushed stone production. The quarry offered a puzzle which some of the best known experts in drilling and blasting were unable to work out; and the plant, while it has worked with fair success from the first, was so unusual in its design that changes have been necessary to make it do what was expected of it. In addition to the interest which comes from the solution of the quarry problem the plant is notable from the number of new methods and devices which have been successfully introduced, some of which are well worth adopting by other crushed stone producers.

The quarry is on the top of a high bluff above the Frisco railroad and the Arkansas river, five miles out of Tulsa. The ledge has been opened to a length of 3300 ft. All this country has been drilled in prospecting for oil, so the stratification of this bluff is well known. The upper 43 ft. are of limestone. Below this is a 36-ft. stratum of shale which rests on 36 ft. of sandstone. Beneath this is a very thick stratum of shale which goes below the bottom of the hill. The quarry is in the 43 ft. of limestone on top.

Naturally this limestone was weathered and eroded on the face, presenting an uneven surface. In addition to this the ledge had been cracked, presumably by earth movements, and the cracks had become filled with dirt and clay. These cracks are not at right angles to the face but run back at varying angles.

THE editors publish this article with a great deal of satisfaction. It not only presents a number of things which are out of the beaten path, but it shows what can be done by an operator who maps out his problems and then keeps after them persistently until he has solved them. The frontspiece on preceding page shows a good general view of the plant.

Part of the face pushed forward in a solid mass

The upper part of the ledge is somewhat stratified but the lower part is a very solid body of limestone without bedding planes or joints, except for the cracks mentioned. While the rock has a French coefficient of wear between 7 and 8, it has a very high resistance to crushing, one test showing this to be 16,000 lb. to the square inch.

The factors that made quarrying difficult were: The ledge is bottomed on a comparatively soft shale bed, on which masses of rock will slide easily. Clay seams are present into which shots will break without fracturing the face of the ledge. The rock, from its high resistance to crushing is, for a limestone, unusually hard to break.

At the start operations had to be confined to clearing off the uneven face of the bluff and establishing a quarry face. As soon as the solid part of the ledge was reached it was found difficult to shoot the rock so that it would break into pieces that the shovel could handle, and experts from some of the powder companies were called in. On the recommendation of one of these 6-in. well drill holes were put down at a considerable distance apart and back from the face. These were loaded with 150 lb. of powder to the hole. The effect was that a big crack was opened, running from one hole to another,

Best fragmentation possible to obtain at this plant with ordinary blasting methods

A good shot, the result of shooting holes with interrupted loading

Plant of Zenith Limestone Co., Tulsa, Okla., showing especially the conveyor to screens and bins over loading track

and the face in front of the holes slid forward on the shale bottom. Charges of 200 lb. and finally 250 lb. to the hole were tried. With the heaviest charges the rock was broken as well as moved, but it was broken into great blocks which had to be blockholed with hand pneumatic drills before they could be handled by the shovel. Any loading of the holes with much heavier charges might have been dangerous, as it was liable to throw rocks over the face of the bluff on the railroad and on the houses below.

Use of Tripod Drills Was Suggested

A consulting engineer who has successfully opened a good many quarries was called in and he recommended the abandonment of well drill hole blasting and the use of tripod drills. These could be used to put in horizontal as well as vertical holes in sufficient number to break the rock without moving it on the base or without the shots breaking into cracks that might be nearby. This system would have undoubtedly been successful, but it meant a considerable scrapping of equipment and a large investment in new machinery. Before this was undertaken the manager, R. D. Long, wanted to try another method which he had worked out from observing the effect of previous shots and from studying the conditions of the ledge.

Mr. Long argued that what was needed was a number of small charges of powder scattered through the body of stone to be broken instead of large charges placed in the bottom of the hole. This would equal the effect produced by putting in a large number of smaller holes with a tripod drill, and he wanted if possible to get the same effect with well drill holes.

The holes were drilled 15 ft. back from the face and 12 ft. apart, but staggered so that every other hole was only half the distance from the face. They were given interrupted loads. Twenty-five pounds was placed at the bottom of each hole and then 50 lb. was loaded in small loads 4 ft. apart, the space between being solidly tamped with earth. The spacing was staggered in the various holes so that the loads in one came opposite the tamping in the next hole, and 60% dynamite was used in all loads. The

The crack follows from one drill hole to another, while the face was pushed forward but not broken

Belt conveyor, screen house and bins as seen from crushing plant

other charges had been of 30% and 40% dynamite.

At the time of the writer's visit in March four or five shots had been fired by this method and apparently it was successful. The fragmentation was excellent, so good that blockholding was hardly required. The face had not been entirely cleared away from the last shot so it could not be seen if any toes were left, but so far as the shovel had worked the breakage was clean and the method appeared to be a success in every way.

High Strength Powder at Many Points

Interrupted or broken loading is not new and the close spacing of the holes is not new, but it is not often applied in this way. The effect of the small charges of high strength powder at many points in the mass of rock has been so remarkable as compared with the other methods that it would hardly be believed if one had not seen it.

The plant is a straight gravity plant, the rock passing from one crusher to another with no return. Experience has now shown this to be a mistake. A certain quantity of oversize is bound to be in the output of the last crusher in the series unless this crusher were to be set to so small a size that there would be overcrushing, with too much loss in fines. This condition is to be remedied shortly if it has not been done by the time this is published. The amount of oversize produced and not returned for recrushing is small, but its accumulation constitutes a loss and a nuisance, as it is not easily saleable.

There are three crushers, all of the Kennedy-Van Saun Manufacturing and Engineering Co.'s make. These are set one almost above the other on the steep slope of the hillside. Each is run by a separate Ideal motor. Following each crusher is a bar screen or grizzly which takes out everything crushed down to size. The final crusher product and the undersize of the grizzlies passes over a cleaning screen of Mr. Long's invention. This takes out the dirt and a little of the fines and it does so good a job in cleaning the stone that the quarry is worked without the overburden being removed. The screenings from the cleaning screen go to a waste dump by a conveyor 500 ft. long and the clean stone goes to a 24-in. belt conveyor with 200-ft. centers that takes it to the sizing screens. There are two of these, each 24 ft. long and 60 in. in diameter, perforated with 2½-in., 1½-in. and 1-in. holes. Each screen is driven by its own Ideal motor.

The grizzlies are found to pass flat pieces that make oversize on the finishing screens. It is planned to replace these grizzlies with a more positive screening device such as one

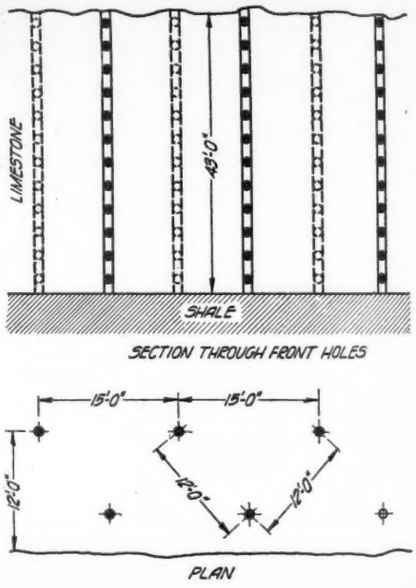
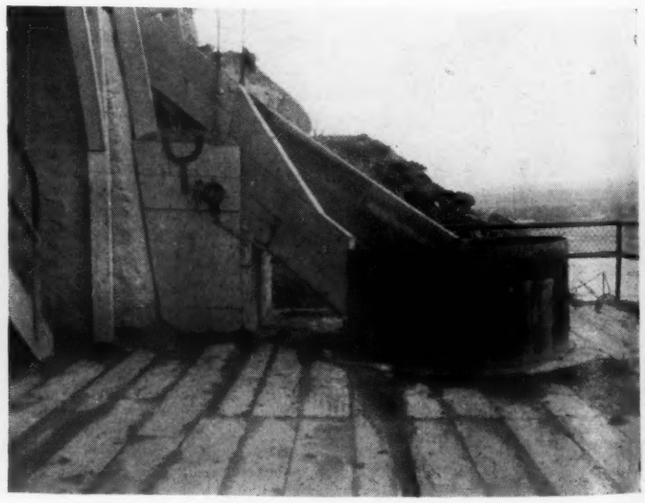


Diagram showing drilling and blasting

Screen and chute to secondary crusher

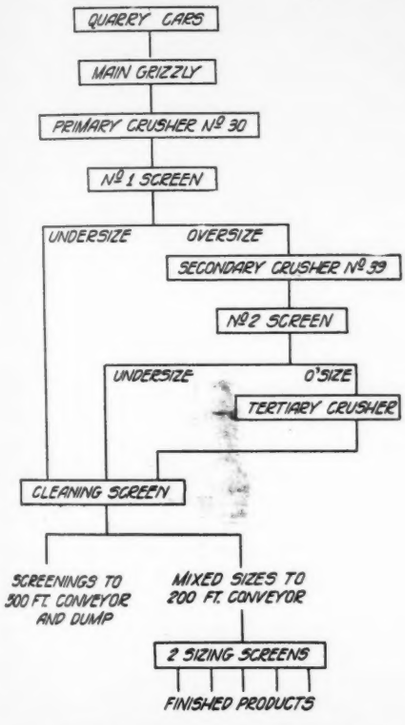


Screen and chute to finishing crusher

of the forms of mechanical grizzlies that are coming into favor at present.

Crushing is very rapid. A stone entering the primary crusher is broken down to finished sizes and on its way to the final sizing screens in less than a minute.

There are a number of new methods and of new devices employed at this quarry which are not only ingenious but worthy of adoption in other cases where conditions would justify a change. The first of these is the drill bit used. An Armstrong 6-in. well drill is used to put down the holes and the bit is sharpened in a peculiar way. There is a flat face on the bottom of the drill from which projects a cutting edge across the center. This cutting edge chips the rock and the flat face mashes down the chips and this combination has been found to drill faster than any other sharpening. It will shortly be described in the Hints and Helps Department.



Flow sheet of crushing plant

Waste conveyor 500 ft. long, and screenings pile, the screenings separated by Long herringbone screen

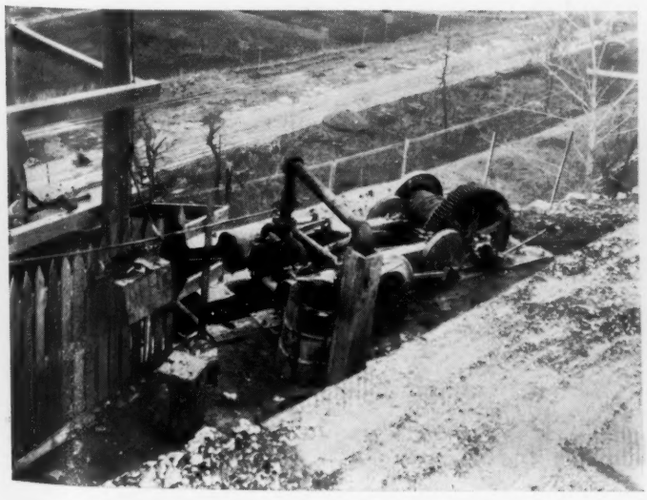
Natural Gas Used for Drilling

Another decided innovation in drilling is the use of natural gas in the place of compressed air for drilling. Natural gas is cheap in Tulsa and has a pressure of 75 lb. at the quarry. It operates the block holding drills as well as air and is used whenever the compressor needs repairs or when for any other reason it is not desired to run the compressor.

Natural gas is used to fire the steam shovels, a Marion 37 on crawler treads and a Marion 80 of the railroad type. Steam shovel firing with natural gas has not been very successful in other places where it has been tried. Mr. Long had to design a new burner and he built one of a multiple type having 150 small burners covering the whole space formerly occupied by the grate bars. This fills the fire box with flame and gives the effect of a hot coal fire. The boiler has been filled with cold water and steam raised to full working pressure in 18 minutes.

The mechanical feature of this operation, which has occasioned more comment than any other, is the method of unloading the quarry cars. The cars are standard gauge, open top cars, but one side and both ends have been removed. The cars are pulled into the switch, where they are attached to a cable that draws them through on the track above the crusher. A plow suspended from a heavy framework rides on the bottom of the cars and plows off the stone, which rolls over a fan-shaped grizzly down to the primary crusher.

The pulling rope goes through blocks and falls before going to the hoist, so the mo-



Hoist for pulling cars past the unloader

First grizzly and primary crusher

The solidity of lower part of face is particularly noticeable

One of the bar screens between the crushers

tion of the cars is comparatively slow, but very strong. The hoist operator is near the plow and he can see how the stone falls off. By keeping an eye on the stones as they fall he can feed the primary crusher steadily. A small Curtis air hoist above the crusher handles pieces of rock that it is necessary to turn.

The cars have bottoms of 6-in. oak on top of which is a ½-in. steel plate. This has shown little wear in the two years that the cars have been in service.

The cleaning screen, which has been referred to, has been described in detail in the Hints and Helps Department (see ROCK PRODUCTS, June 12). In brief, this screen is made up of cast iron sections, 3-ft. 6-in. long and 12 in. wide. Each section is filled with herringbone slots ¼-in. wide at the top and about ¾-in. wide at the bottom. This enlargement of the openings keeps them from blinding. The point of the herringbone is placed in the direction of the flow. This screen has a good many advantages over the wire and perforated metal screens used for the same purpose. An important advantage is that it will wear a long time without needing replacing.

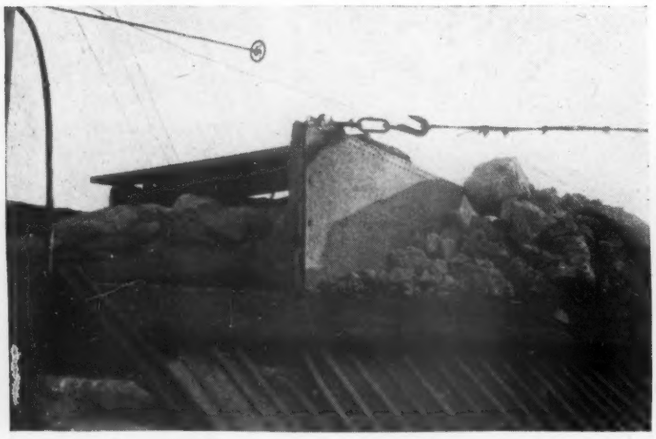
Sections of this herringbone screen have been put in wherever the stone passes on its way to the final screening and the result is a clean stone free from fines.

The company's offices are in the Lorton building in Tulsa, Okla. H. H. Bell is president of the company and R. D. Long is vice-president in charge of plant operation.

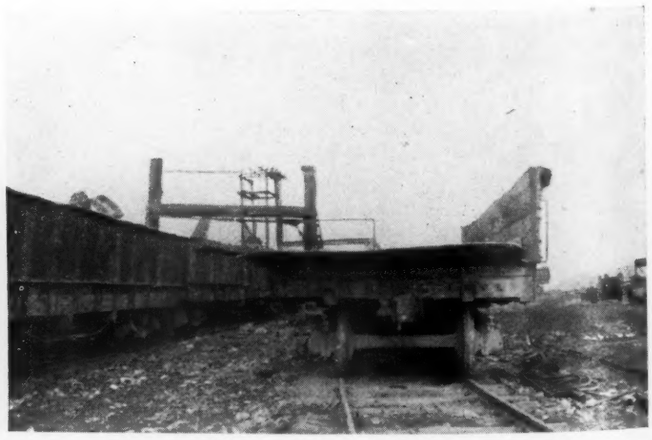
New Franco-German Potash Agreement Rumored

A NEW agreement has been negotiated between the representatives of the German potash syndicate and the French state and private potash industries, according to semi-official reports. This new agreement, which is to last two years, is considerably more comprehensive than any past arrangements and introduces a complete regulation of sales in all export markets. Under the terms of the new convention France guarantees that the Alsatian potash industry during the coming two years will not enlarge the scope of its production with a view to renewed competition. No new mines will be opened and the number of pits being worked in the mines will not be increased.

In compensation for this concession Germany guarantees the maintenance of uniform prices, which will be established in common accord with the Alsatian industry. The distribution of the world market between the two industries will be made on a proportion of 30% to the Alsatian mines and 70% for Germany. Each industry, however, will keep its home market for itself. This clause leaves room for some expansion of the Alsatian industries, as, at the present time, the German market absorbs 7,500,000 quintals of potash, while the French market last year only consumed somewhat over 750,000 quintals. The consequence of this new agreement, it is expected, will be a general increase in the price of potash on the world market, which, at the present time, is below Germany's internal prices.—*New York Tribune.*



Plow that unloads cars and sends rock over initial grizzly to primary crusher



"One sided" car used at this quarry, with frame holding unloading plow in rear

Portland Cement Specifications Revised by Testing Materials Society

Changes Also Made in Specifications for Aggregates, Lime and Gypsum Plaster

THE 29th annual meeting of the American Society for Testing Materials, held at Atlantic City, N. J., June 21 to 26, was more important to the rock products industries than any other meeting that has been held since the nationally accepted portland cement specifications were adopted; for this meeting adopted important changes in these specifications and caused the revised specifications to become permanent standards at once, without the usual wait of one year for criticism and suggestions. There were also adopted important tentative specifications for gypsum and lime. The report of the committee on aggregate specifications showed that progress had been made, although the committee is apparently not fully satisfied with the present tentative specifications, since it did not recommend making any of them standard.

The meeting was very well attended, the registration being 1150, the largest attendance yet recorded. The 12th and 13th sessions, which were those of greatest interest to rock products producers, brought out a good attendance, especially when the cement specifications were being discussed.

Cement Requirements Raised

The change in the requirements for tensile strength of standard portland cement mortar briquettes from 200 to 225 lb. at 7 days and from 300 to 325 lb. at 28 days had been so much discussed in Rock Products and other publications that this change was accepted without comment. But this was by no means the only important change made by committee C-1, and included in its report, which was presented by R. S. Greenman, chairman. Several important changes in the technique of testing were adopted, and it is believed that these will lead to much greater uniformity in the work of various laboratories, so that the results of one will check those of another more closely than they do at present.

Regarding the changes in portland cement mortar tensile strength requirements, the report says that these were "proposed to meet an evident disposition among some users of cement" to write their own specifications, and also in the light of the work of the special subcommittee of C-1 on survey of tension tests of portland cement for 1925, which made a very thorough analysis of cement tests, embodied in special report No. 40S.

A Survey of the Whole Cement Field

The committee which prepared this report included Duff A. Abrams, of the Lewis Institute, Chicago; R. S. Greenman, office of state engineer, Albany, N. Y., and Sanford E. Thompson, president of the Thompson & Lichtner Co., Boston. There were 172 laboratories which reported tests to the committee, on 942 samples of cement. The number of tests made was 180,083 and these represented 184,623,432 bbl. of cement sampled, which is somewhat greater than a year's output of portland cement in the United States. Some were duplicate tests on the same cement, but the tests received from cement manufacturers covered 95% of the cement made in 1925. Hence the report shows the present quality of American made portland cement about as completely as is possible.

High Quality of American Made Portland Cement

The report is largely made up of tables giving details of tests. The whole is summarized in a table from which the totals of weighted percentages are: Below 200 lb. per square in. 0.3%; from 200 to 224 lb. per square inch, 5.7%; from 225 to 249 lb. per square inch, 18.8%; and 250 lb. per square inch and over, 75.2%. Hence we may say of the cement made in 1925 that only 0.3% failed to reach the standard strength requirement, that only 6% would have failed to reach the increased strength requirement just adopted, and that 75.2% had a much greater strength than is required by the new specifications. It is evident from this that engineers were justified in asking for a higher strength requirement in specifications and that the committee was justified in recommending it.

Change in Testing Methods

Other changes in the standard specifications (C9-26T) are as follows:

The requirement for specific gravity has been dropped altogether.

Under "Packing, Marking and Storage," the requirements have been amended to cover shipping advices with bulk shipments and condition of packages.

Under "Inspection" the time allowed for the 7-day test has been increased to 12 days and for the 28-day test to 33 days. The 28-day test need not be made if waived by the purchaser.

Under "Rejection" the word "may" has been changed to "shall," to make rejection mandatory if the cement fails to meet requirements. A new requirement calls for retesting after six months' storage. Provisional acceptance of the cement at the mill shall not deprive the purchaser of his right of rejection on a retest of soundness and time of setting at the time of delivery, under the new specifications.

Under "Sampling" the size of the sample has been reduced to 4 lb. and the quantity represented by a sample to not more than 100 bbl. Sampling shall be done under the direction of a responsible representative of the purchaser, and samples must be held in moisture-proof as well as air-tight containers.

Under "Chemical Analysis" minor details have been changed in the methods for determining insoluble residue, sulphuric anhydride and magnesia, but the requirements are substantially the same as before.

For "Determination of Fineness" the requirements have been brought in line with the society's tentative specifications for sieve requirements. The standard No. 200 sieve is one having a nominal opening of 0.0029 in., certified by the Bureau of Standards and conforming to the society's requirements in specification E11-25T. Notes on the method of sieving have been added.

Of special importance is the requirement given in paragraph 34, which says that: "The temperature of the room (in which cement pastes and mortars are mixed), the materials, the mixing water, the moist closet and storage tanks shall be maintained as nearly as practicable at 21 deg. C. (70 deg. F.) and shall not vary from this temperature more than 3 deg. C. (5 deg. F.)." This is more definite than the former requirement.

Minor details have been changed in the determinations for normal consistency, soundness and time of setting.

Probably the most important testing revision is that of paragraph 51 of the standard specifications. This now gives definitely the manner of making briquettes and calls for a pressure of 15 lb. in "thumbing." The paragraph on the machine for testing (No. 52) has also been completely revised and so have those relating to the storage of test specimens.

There was some discussion on the above modifications of testing methods, but no particular opposition to any of them developed.

When it came time to vote on the adoption of the committee's report as a permanent instead of a tentative standard there seemed to be some objection. But it was stated that many of the changes were already adopted by the American Engineering Standards committee, and P. H. Bates showed that the report was in line with the requirements of the Bureau of Standards for testing cement, so that uniform specifications for the whole country would result if the specifications were made permanent at once. The chairman pointed out that a nine-tenths vote would be necessary. The report was adopted by a unanimous vote.

Comparative Research on Portland Cement

Dr. A. H. Bogue followed with a paper on "Comparative Research on Portland Cement" which was somewhat disappointing after one had read the abstract given in the program. No real information as to how far the constitution of portland cement had been determined was given. Much of the paper dealt with the relation of scientific research to practical engineering problems, and while this was interesting it was not satisfying to those who were looking for something definite in the way of conclusions. The method of research as explained by Dr. Bogue as now practiced was to work on the simpler systems of lime, silica and alumina combinations brought to constant equilibrium. He spoke of the necessity of a systematic study of equilibrium in compounds of these elements and showed that any point in the field might be established by the application of the phase rule and the mass law, where equilibrium had been reached.

His laboratory is trying to establish agreement between the results obtained by European and American workers, referring presumably to the conclusions which have been drawn on the formation of di-calcium and tri-calcium silicates. In the earlier part of the address he suggested the possibility of new compounds playing their part in the constitution of cement.

A second line of attack was to determine the effect of *each* constituent and compound in cement, including the lesser ones, their effect as fluxes and catalysts in manufacture, and their effect in setting and hardening in use.

As Dr. Bogue pointed out, portland cement research is not a thing to be attempted by ordinary laboratories, for special and costly apparatus is needed and the time required is unusually long. As an example of the expensive apparatus required, he mentioned a furnace, in part of platinum, in which temperatures to 1625 deg. C. could be maintained with a variation of less than 10 deg. C.

Improvements constantly are being made in microscopical and X-ray studies, and these are being applied to portland cement.

Cooperative Cement Testing

The revision of cement testing methods was shown to be important by the paper on "Cooperative Cement Testing," by S. R. Mitchell, chief chemist of the Riverside Portland Cement Co., Riverside, Calif. He showed how successful cooperative work had been in his experience, the different laboratory workers in a field getting together and agreeing upon points in manipulation. He gave some examples of seemingly slight causes which had been the reason for poor checking on the same samples. Four laboratories were found to be working with faulty apparatus which included worn moulds and clips for briquettes, non-sensitive chemical balances, mixed weights of avoirdupois and metric systems, dirty storage tanks, and the like.

In one case cooperative testing taught one of the laboratories that the specifications required the briquette to be turned over, rethumbed and finished off. Doing this eliminated differences in checking. In another case too much water was used in making the briquette, and while the excess amount was only 0.5%, the effect was to decrease the tensile strength 20%, a striking confirmation of the importance of the water-cement ratio. Checking the sieves used in different laboratories showed some to be so worn as to make a difference of 5% in the report on fineness. In one case the wrong factor was used for the permanganate solution in determining the lime content, and in another a "loss on ignition" of 4.25% was traced to moisture absorbed by poor handling of the sample in transit.

Tension and compression testing, the tests which have been found most difficult to check by different laboratories—even good ones—were brought to an agreement within 10% by cooperative work. One of the interesting causes of erratic early strength tests was found to be the improper oiling of briquette molds and plates, the oil interfering with the proper hydration of the cement.

Changes in Gypsum Content of Plasters

The standard specifications for gypsum (C28-21) adopted in 1925 were tentatively changed in regard to the gypsum content of plasters. In all cases the change has been made to raise the quality of the product.

Tentative specifications for gypsum molding plaster, gypsum pottery plaster and for Keene's cement were also adopted. Publication of these is reserved for a later issue.

An interesting paper on the chemical and microscopic determination of anhydrite is included in the committee's report. It is mainly a relation of the reasons why the present methods of determining anhydrite are at fault, but there are some suggestions that might be followed out to devise better methods. Among the interesting things pointed out is that grinding the sample according to the procedure of the A. S. T. M. will increase the apparent content of anhydrite about 2%, due to the dehydrating of gypsum particles by grinding. The analyses of gypsum by portland cement companies usually show too large an anhydrite content on this account.

Lime Specifications

The tentative specification for quicklime for building purposes (C5-24T) was advanced to standard on the recommendation of the committee. These specifications have stood two years without criticism. The lime committee C-7 has in preparation specifications for quicklime and hydrated lime for use in the sugar and fruit juice industries and for the manufacture of calcium arsenate. It is also preparing specifications for lime in glass manufacture and lime for causticizing.

The sub-committee on methods of testing lime has recommended some changes in the determination of insoluble residues, silica and sulphur.

As an appendix to the lime committee's report (No. 45) there is a report on the test panels made by the Bureau of Standards to determine the effect of various materials in the finish coat of plaster. It was found that core (ground limestone) and mica had no effect whatever. Magnesium sulphate and sodium chloride cause efflorescence. Iron carbonate, pyrites and lime "burned" during hydration are all causes of unsoundness; and "overburned" lime will always give trouble, regardless of the size of particles. Tannic acid was found to prevent hardening and to leave the panel with "fire cracks."

Changes in Grading of Aggregates

The aggregate committee recommended a change in the grading of sand, the amount passing a No. 50 sieve to be not more than 25% nor less than 5%, instead of "not more than 30%," as the specification (C33-23T) now reads. It was also recommended to change the percentage passing the No. 4 sieve from 15% to 10%. In the table of limits of gradation in Section 9 it is recommended to add the percentage of 40-75 for the 1-in. sieve in the case of the 2½-in. maximum size.

Other recommended changes are to bring the work of sampling and sieve analysis in line with the general practice of the society in these matters.

A sub-committee of the aggregate committee is at work on a report on the causes of disintegration of concrete. This will include not only the effects of porosity and changes in volume due to changes in temperature and moisture, but the effect of frost on different types of aggregates and mixtures, and the relation of the durability of concrete to the quality of the aggregate of which it is made.

Definiteness Wanted in Terms Relating to Concrete

In discussing the proposal for a specification for portland cement concrete, Cloyd M. Chapman, consulting engineer, New York, reviewed the problem of the specification writer and made some pertinent remarks on the indefiniteness of the terms now used to define qualities of aggregate, such

as "hardness" and "cleanliness." He asked "How hard is hard?" and how shall one distinguish a sand having grains just hard enough to pass from one which has grains just too soft to pass? And he asks if we shall continue to specify that sand must be "clean" when we provide no way of determining that it is unclean. The point would seem to be well taken, and the various societies which are now working on aggregate specifications might bear it in mind.

Mr. Chapman in the course of his remarks said that it might be necessary to make more than one kind of portland cement, since different kinds of concrete were needed for different uses. This was promptly taken up by Robert W. Lesley, who spoke of the state of the things in the 90's when the walls of his company's laboratory were literally papered with cement specifications, over 200 of them being in use. Nobody wanted to see those days come back or wanted to see more than one material, made to pass definite specifications, referred to as portland cement.

The report of a series of tests on the use of calcium chloride in curing concrete in cold weather showed that calcium chloride has real and measurable value for that purpose.

Other excellent papers dealing with special phases of testing and the like were presented at the sessions reported.

Definition of Sand

The committee on nomenclature and definitions has a sub-committee on definitions for "sand" and "aggregate" which recommended an entire change in the definition of sand. A tentative definition was already in effect and the sub-committee had in mind recommending it for advancement to standard and so advised the standing committees of the society. The definition was as follows:

"*Sand.*—The fine granular material resulting from the natural disintegration or the crushing of rock or slag.

"NOTE.—When used without a qualifying adjective it is generally understood to mean a product of the natural disintegration of siliceous or calcareous rock. The size of particle and other physical characteristics should be taken care of in specifications and therefore no limits are mentioned in the definition."

A number of criticisms of this definition were received, which, briefly summarized, are the following:

1. "Sand" should only include the product of the natural disintegration of rock.
2. "Sand" should be limited to only hard, durable materials. (Some even suggested that the definition be limited to siliceous or possibly siliceous and calcareous materials.)
3. A size limitation of ¼-in. should be given.
4. "Sand" should not include "crushed slag."

While several of these objections were held to be scarcely pertinent, in that the definition was not intended to be a specification for sand suitable for a specific purpose, one or two of the objections seemed to the committee to have real merit. Probably the most valid objections, it was stated, were those to the effect that "sand" should not include stone screenings, nor should it include slag, even though terms such as slag-sand may be in general use and accordingly might imply the desirability of a generic definition for sand. The sub-committee accordingly presented the following definition to replace the former tentative definition for the term "sand":

"*Sand.*—The fine granular material resulting from the natural disintegration of rock, or from the crushing of friable sandstone rocks.

"NOTE.—When used without a qualifying adjective, 'sand' is generally understood to mean the product of the natural disintegration of siliceous or calcareous rock. Sand should be distinguished from screenings, gravel, etc. The size of particle and other physical characteristics should be taken care of in specifications. The fine material resulting from the crushing of blast-furnace slag is known as 'slag sand.'"

The definition was accepted with the addition of the parenthetical phrase, "less than ¼ in. in diameter" after the word "material" in the first line.

In the 1925 report of the committee a definition was presented as information for the term "aggregate" reading as follows:

"*Aggregate.*—Inert mineral material which when bound together into an agglomerated mass by a matrix forms concrete, mastic, mortar, plaster, etc."

It was pointed out that this definition was faulty in that "aggregate" was not necessarily mineral material. On the other hand, some qualification needed to be given so as to exclude extraneous substances from falling under the definition for "aggregate." To provide for this the introductory word "designated" is employed in the following definition, which was recommended for publication as tentative:

"*Aggregate.*—Designated inert material, which when bound together into an agglomerated mass by a matrix forms concrete, mastic, mortar, plaster, etc."

Increase in Magnesite Tariff Opposed by Importers

OPPOSITION to a proposed increase by 50% of the rates on imported magnesite was made by importers and consumers at the magnesite cost hearing before the U. S. Tariff Commission in Washington, D. C.

Patrick H. Kelly, of Philadelphia; Montague Hankin, of New York City, and Henry A. Golwynne, also of New York City, contended a 50% increase would result in the domination of the domestic magnesite industry by a few producers.

Mr. Kelly also said it was a question of prices with him. He declared he was in the stucco manufacturing business and sought the raw materials at the lowest prices obtainable.

Says Business Fell Off

Mr. Golwynne testified that he was an importer of Indian magnesite and that his business had fallen off in 1925. He told Chairman Marvin, in response to a question, that New York City was the principal consuming point. He differed with a statement of Mr. Kelly that business was increasing in Pennsylvania.

Mr. Hankin said he represented the Marbleoid Co. of New York, which, he said, used ground magnesite in the manufacture of flooring. He said the increase in tariff requested was not justified.

Production Figures Given

Mr. Golwynne read into the record his production cost figures and said the domestic producers have an advantage over the markets that consume 50% of the total consumption.

Mr. Golwynne explained that the rate of exchange and ocean freight rates were factors in costs in handling the imported product.

J. H. Sands and Walter Gardon Merritt acted as counsel for the consumers and importers of magnesite.

George Hamilton and W. J. Thorn, both identified with the American offices, in Philadelphia and New York, or Innes-Speiden, Ltd., London, also testified in opposition to an increase on magnesite rates. Mr. Hamilton said his company was selling magnesite in this country at an average price of $50 a net ton, although it cost the company $52.50 a net ton, including overhead and selling expenses.

Mr. Thorn's testimony was confined largely to the selling and distribution of the product in competition with the domestic product.

No Rebuttal Testimony Offered

J. A. Bernhard, representing the Sierra Magnesite Co., one of the complainants, told the commission he had no witnesses to offer evidence to offset the selling and production costs of the importers.

Mr. Bernhard further explained that he came prepared only to answer certain questions propounded in the commission's tentative report.

Mr. Merritt, for the importers, in summing up his case, said the evidence should be scrutinized carefully.

Chairman Marvin, replying, said the evidence would be given careful consideration and then asked both sides to present their briefs and other information to fill certain gaps in the record on or before July 19, 1926.

Dredge recently put into service by Keystone Sand and Supply Co. of Pittsburgh, Penn.

With Producers of Western Pennsylvania

Notes of an Editorial Trip Among Leaders in the Rock Products Field

By Edmund Shaw
Editor, Rock Products

PITTSBURGH is like other representative American cities in that it can show some good and some bad jobs of concrete. Probably the proportion of bad jobs is not greater than in other cities, but there were enough of them so that someone has formulated a theory that the climate of Pittsburgh has had a peculiarly disintegrating effect upon concrete. The only objection to the theory was that the good jobs of concrete refused to be disintegrated by this peculiar atmospheric influence.

Aggregate Specifications for Pittsburgh

However, the engineers of Pittsburgh and vicinity, who formed the Engineers Society of Western Pennsylvania, determined to investigate the whole matter of concrete making and called the producers of aggregate to serve on a concrete committee. This seems a wise move, for the producers of aggregate know best what materials can be most economically produced and what the aggregate resources are. Out of the committee's deliberations came a specification for local aggregates which was adopted in the early part of the year. It applies to sand, gravel, crushed stone and slag.

Comparison with the purchase specifications proposed by the American Concrete Institute (see ROCK PRODUCTS for June 12) shows that there is no material difference except that the Pittsburgh specifications are definite in some matters which the other specifications leave open for local determination. As examples, a weight of 70 lb. per cu. ft. is placed as the lowest allowed for crushed slag, and gradings are given for fine, medium and coarse gravel. A special grading for fine sand (suitable for mortar, plaster and concrete) is also given.

Dr. David Hale examining a baby in the clinic at Bellefonte, Penn.

The Same Sand Was Too Coarse and Too Fine

This is just another evidence of the desire of both producers and users of aggregate to have definite specifications established. As the matter now stands, some absurd situations arise. One of the largest producers in the Pittsburgh district told me of two cases which will illustrate this. One was of a shipment of sand which was too fine to pass Pennsylvania highway concrete specifications and too coarse to pass Ohio specifications. The other was of three shipments made at the same time and from the same bin to three different political units. The engineers representing two of these units called up to say that the sand was too coarse, and an engineer from the third called up to say it was too fine.

In these days of large scale production it is impossible to do business on the basis of a dozen or more specifications for such material as concrete aggregate. It costs too much both in money and time to make special gradings, most of which are based on a personal opinion, for the characteristics of good aggregate are known well enough to allow a standard to be fixed that will satisfy everyone.

It is to be hoped that the example of the producers and engineers of western Pennsylvania will be followed in other parts of the country. If this is done it will be a long step toward the goal which every honest producer and user of concrete is trying to reach—that all concrete shall be uniformly reliable and permanent.

The society adopted these specifications before the tentative specifications of the American Concrete Institute were published. Now that these have been published, it would seem well for local bodies to adopt them, with such modifications as local conditions make necessary.

The society does not intend to stop with an aggregate specification. It will go on with a study of concrete made from local materials, which will include cements, water-cement ratio, and mixing and placing.

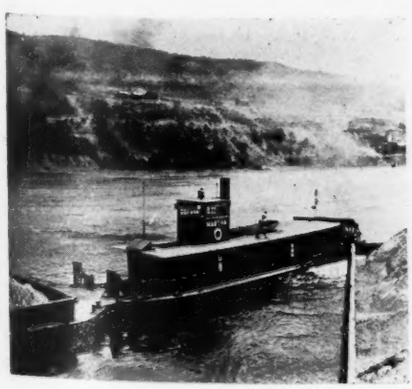
Dravo Dredge No. 8

The special reason for visiting Pittsburgh on this trip was to see Dredge No. 8 of the Keystone Sand and Supply Co., which has now been in service for about a year. It is a magnificent digging machine. It uses only 100 hp. on its bucket line and with this it excavates over 10 tons per minute from the bottom of the river, elevates it 50 or 60 ft. and delivers it to the washing screen. The bottom of the Ohio river is notoriously hard digging and few excavators of any type can show more work done with the same expenditure of power. In addition, it is a complete sand and gravel washing and screening plant and turns out an excellent quality of material. It was working near Steubenville, Ohio, when I visited it, and most of the output is going to a big dam which is being built at Toronto, Ohio.

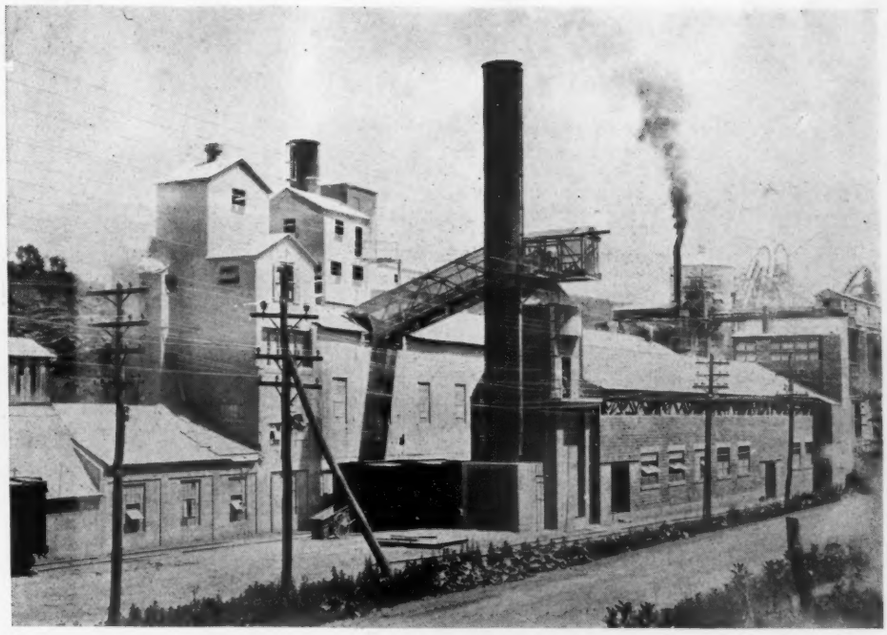
Dredge No. 8 is a sister to the dredge which was built for Capt. Duffy of the Ohio River Sand Co. (Louisville, Ky.), and launched a little over a year ago. Both were built by the Dravo Contracting Co., with which the Keystone company is affiliated.

The World's Largest Block Plant

An interesting visit was paid to the concrete block plant of the Henderson Structural Unit Co., which is pretty well known in the cement products industry as the largest block and tile plant in the world. It turns out 20,000 units (block and tile) daily, using both sand and crushed slag as aggregate, and it is the type of large scale production plant of which more will be built in the future as the ever-growing market for concrete building units demands them. The plant is situated at McKees Rocks, which is just outside of Pittsburgh, in the heart of a very busy industrial section. A considerable proportion of its product goes into industrial buildings, such as warehouses, but one of the largest users was said to be building private garages.



One of Keystone's new oil engine tow boats

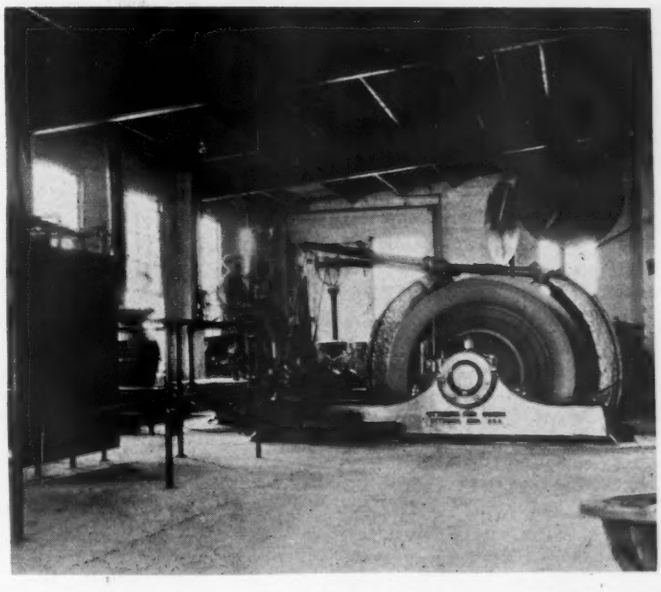


Kiln houses at Bellefonte, showing building which houses new rotary kiln in front

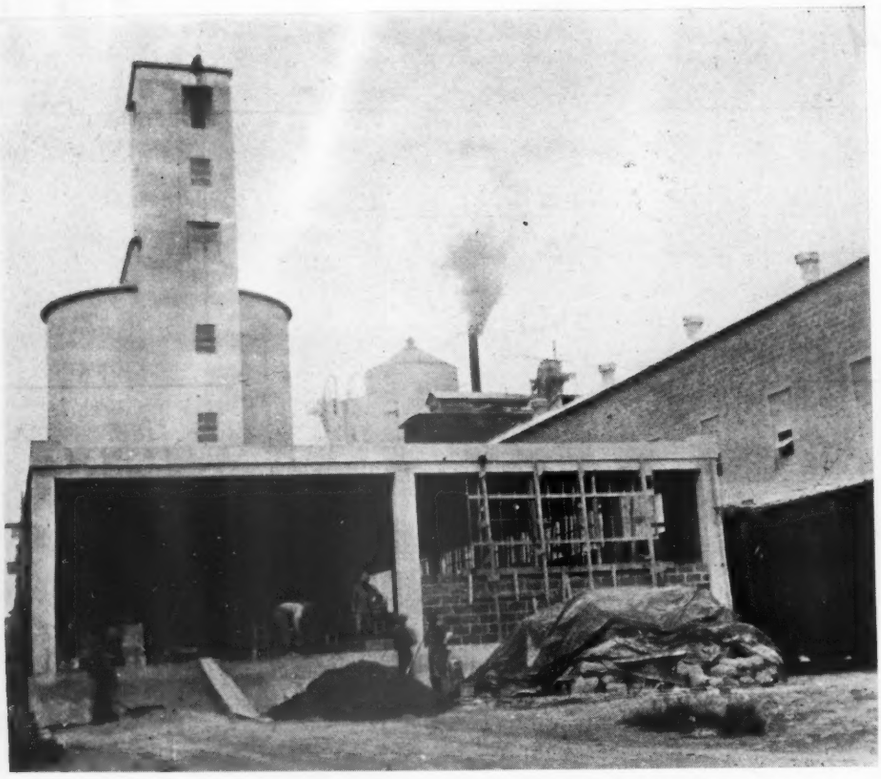
Buckets of dredge No. 8 are joined by lugs and pins to form a chain

Improvements Made by the American Lime and Stone Co.

A few days at Bellefonte, Penn., were given to studying some phases of personnel work which has been more than usually successful there. But a number of important changes in the plant itself have been made since its description was published in Rock Products in 1922. A new 175-ft. rotary kiln has been added and new storage of the silo type for burned lime. A new factory for making steel barrels is under construction. The company has long made its own steel barrels and is merely giving this department better quarters. Wood barrels are also used, but these are found to be more cheaply purchased. A new No. 7½ crusher is being installed.



Mine hoist by which skips are raised from the mine



American's new steel barrel shop and lime storage

A visit to the mine was an interesting experience. The mine itself and the method of working have already been well described in J. R. Thoenen's articles, so only personal impressions will be noted here. Western metal mining and not eastern coal mining practice appears to have influenced those responsible for the layout, or perhaps a combination of methods would better describe the engineering practice. The main impression gained by the underground trip was that of much greater comfort and safety than was present in mines with which the writer was formerly familiar. The broad and high stations at the shaft, the ample drifts, the excellent lighting everywhere, and the clean and well-kept appearance of everything all spoke of this. It is no wonder that the men say they much prefer working underground to working in the quarry.

Studying Kiln Practice

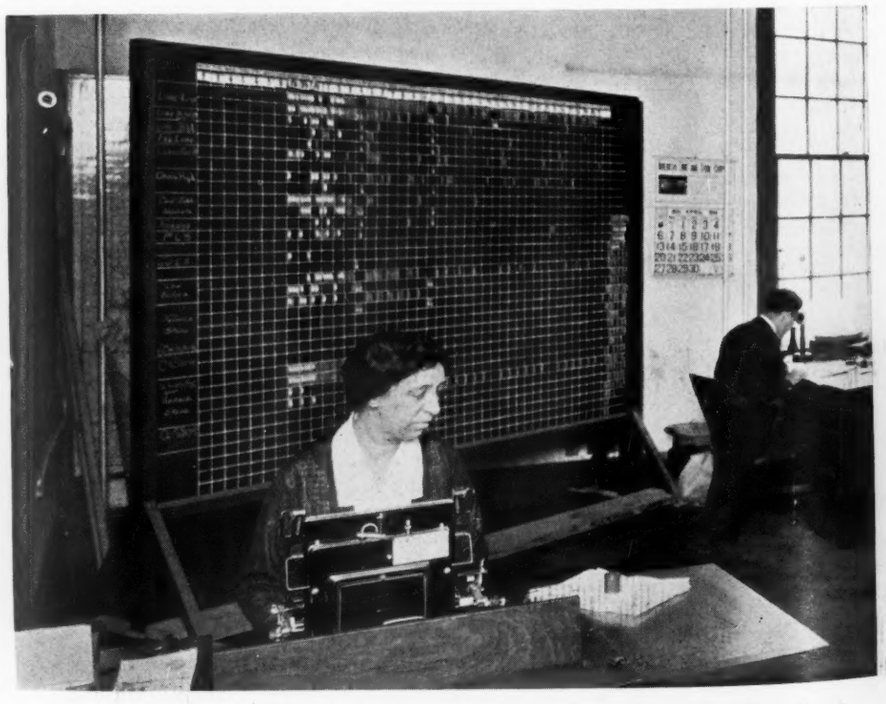
All the stone for burning in both shaft and rotary kilns now comes from mining, for in that way a better and more uniform grade of stone is obtained. The objection to mining from the ordinary lime manufacturer's viewpoint would be that mining produces a great deal of fines, but as rotary kilns burn so large a portion of the product at Bellefonte, that objection does not apply here. Newly opened stopes produce more fines than the older stopes. By having different stopes to draw from, the proportion of coarse and fine may be regulated. Kiln stone is taken off at the surface and sent to the shaft kilns and the remainder is sent to the crushing plant and the rotary kilns.

The rotary kilns are fired with producer gas and both kiln and producer gas practice are being intensively studied at the present time, and improvements in fuel economy have resulted. Prof. O. A. Knight, of State College, has assisted in this work. Prof. Knight has also done some important work in the heat treating of drill steel, and by determining exact temperatures at which the changes in the crystalline structure of the steel take place has practically doubled the life of drills. The old method of tempering "by eye" is hardly good enough for modern industrial standards. It has been conclusively shown that even a good blacksmith will temper drills differently on a dark day from a light day, and that this difference in tempering will be shown in the durability of the steel in drilling.

It is natural that such work as this should be undertaken and that it should show practical results, for Samuel Shallcross, the present general manager, was an industrial engineer before he took charge of the management, and had made investigations into many different manufacturing processes. This broad general training in the fundamentals of industry is a most valuable asset, and it is a pity that so many men come to managerial positions with no more knowledge than they have gained in passing through the departments of a single industry. Rock Products has often pointed out how much valuable information was available from other industries to be applied in the rock products industries. But when such information is wanted, instead of being brought from another industry, it is usually acquired by long and costly experimenting.

Use of Boards and Charts

Another feature that shows the hand of the trained industrial engineer is the use of boards and charts to record daily figures pertaining to production and shipments. Perhaps the simplest of these is a chart showing stocks on hand. These stocks are held in steel silos and the chart is a drawing of the silos with the rings of plate which compose it plainly marked. Everyone interested knows what the depth of a ring means



Record board which furnishes information at a glance in office of American Lime and Stone Co., Bellefonte, Penn.

in tons or barrels. Reports of stock are brought in to the shipping department and a black tag is placed on the proper ring. The advantage of the chart is that everyone who needs to know about the stock on hand can glance at the chart and have the information. Slips get lost and it may be too much trouble to go upstairs and look in the book, so a man will take a chance and guess at what is on hand unless he has such information before him in some such way as this.

Large boards on which numbered tags are hung keep track of orders and shipments. Each vertical line is under a date and as orders are received a yellow tag is hung under the date on which it is to be filled. A blue tag is placed over the yellow tag when the order is filled. A board with numbered tags in the general manager's office not only shows orders and how they are filled, but carries it on as a record through the year, so that the state of the business and how the orders are coming in may be told at a glance. The mere grouping of the tags on this board, without reference to the numbers on the tags, gives a very good idea of the condition of the business to one who is trained to read it.

Blackboards are used to collect miscellaneous data so that it can be quickly read and followed from day to day, and a large map on a wall in the shipping department serves for working out all kinds of traffic problems. The usual system of pins with colored heads is used with this map.

Blackboards Are Useful

Mr. Shallcross says that board systems of keeping track of orders and shipments are particularly useful where shipments are in large units, such as carloads, and where the number of products handled is not too great. For this reason such a system ought to work well in the cement, crushed stone and sand and gravel businesses.

A full description of the work for encouraging safety, training the personnel and working for the betterment of employes will be published later. An unusual attention is paid to this work in all the Charles Warner companies, for Mr. Warner was among the first to realize its importance. Accident insurance, for example, was in operation in his companies long before the law calling for it was passed. And the results of such work are apparent to one who visits such a plant as that of the American Lime and Stone Co. and uses his eyes and talks with those in charge of the men. Personnel work has had a hard fight to establish itself everywhere. Old habits die hard and men are quick to resent any move that seems to infringe on their privacy and independence. But a new feeling is being brought about as managers and employes understand one another better. The employe no longer fears that he is to be drilled into a mere machine minder; he understands that he is valued for the mental ability he can show in his work. And the manager no longer feels that welfare work is disguised charity. He thinks of it as something that will help production—which is the end and aim of all energy put into industry.

Plant of American Lime and Stone Co., Bellefonte, Penn.

The baby clinic is the most picturesque and attractive side of welfare work, and also the hardest to harmonize with one's ideas of lime production. But it is not only explained, it is justified when one thinks how much worry may interfere with a man's work. And there are fewer worries that go deeper than anxiety over a sick baby at home.

Fortunately for the people who live there, the clinic has proved that Bellefonte is a good place in which to raise babies. The pure air of the hills, the freedom from flies and mosquitoes, and the lime in the soil are responsible for this. Possibly the lime in the soil is more responsible than the other things for the fact that very few children who have been examined at the clinic have been found seriously underweight or defective in any way.

Plant of Henderson Structural Units Co., McKees Rocks, Penn.

Re-opens Gilboa Plant

THE reopening of Gilboa Quarry on the River Road above Lambertville, N. J., affords employment for some forty men and materially increases industrial activities of this community. This quarry is owned by the Delaware River Quarry & Construction Co., as well as the large quarry owned and operated at Moore Station below the city.

The plant has a capacity of 1500 tons of crushed stone per day of ten working hours. Most of the stone is shipped to Pennsylvania for road building.

Practical Aspects of Lime Research

Report Presented at the Recent Annual Convention of the National Lime Association at French Lick, Ind.

By G. J. Fink
Director, National Lime Association Laboratories

RESEARCH is always found in both the vanguard and the rear guard of sound and successful promotion of any product. As one of the advance forces it must develop information and data by means of which new lines of attack are opened and with which safe bulwarks of fact may be built up in defense. Behind the lines it must be continuously bringing up new forces and ammunition in the form of further or different facts and results, and must be building up a reserve of new uses, methods or processes to be rushed up as the original forces become useless or to be held in reserve as a defense against counter-attacks.

Men and forces engaged in promotion should not be compelled to rely entirely upon precedent. As Edmund Burke once said: "When a great man has some one object in view to be achieved in a given time it may be absolutely necessary for him to walk out of all the common roads." So, we cannot hope to reach our goal with lime if we all the time keep to the beaten paths. It is helpful to be able to tell a contractor or architect that his fellow contractor or architect in a neighboring city used or specified lime in the concrete for a certain famous job. But we will be still better armed and fortified and much more effective if we can demonstrate clearly and concisely just why lime improves concrete. The research department of the National Lime Association serves and should be utilized as the storehouse of such information as is already available relative to the whys of these things and it proposes and should be expected to develop required data when the information does not already exist.

Science and Business Must Be Co-ordinated

The use of lime involves operations all of which are governed by scientific principles and laws, and hence the success of any promotional efforts or of any organization such as ours must depend upon the perfect and happy co-ordination of scientific facts with business principles. Research by the development of accurate data and the discovery of fundamental principles renders an ever-increasing and necessary service, while business methods through organization provide for a profitable application of this service. The justification for a research department in any organization is the need for accurate scientific information and fundamental data and the justification for our various promotional departments is the need for a means for applying and using these facts. And here is a principle, in the words of Dr. H. E. Howe, which applies not only to our own staff, but to our member companies as well: "It is the ability to apply the information that makes the difference between the success of rivals."

RESEARCH must answer two questions, "Will it work?" and "Will it pay?" says Dr. Fink. As told in this paper, his department is trying to answer both of these questions for any given condition which may arise. It is a big undertaking, requiring for its successful accomplishment the united encouragement of the entire lime industry.

A promotion organization is inefficient and ineffective if not securely grounded in demonstrable knowledge, and if this knowledge is not defended in every detail by complete and authoritative research. In common parlance we must "know what we are talking about," and we must be able clearly to distinguish between fact and opinion.

But likewise the results of scientific investigations, however extensive and important, are valueless without the means for application. If, as Mr. Elwell has pointed out, we know that lime plaster has better acoustic properties and is more fire-resistant than other plasters, then we can speak authoritatively and the facts are demonstrable. His department must know the facts and likewise member company salesmen must also know the facts in order to capitalize the work of the promotion men. The serious task of lime manufacturers is to get the available information used. If you do not have the facts your recourse is to call upon the proper department of the association and if the facts are not available, the research department is expected to get them.

The practical value of research by trade associations was recognized by Great Britain early during the war, and since the war the development of such research bureaus by associations has been encouraged by that department of the government especially set up for the purpose, known as the Department of Scientific and Industrial Research.

THE 50% increase during the past year in the number of lime plants employing chemists indicates the increasing desire to improve the product and to sell service.

A number of our competing industries in this country support research organizations and still more are being set up. Those industries whose products from the beginning have been systematically promoted and whose production and promotional activities have been founded on a scientific basis have shown the most decided upward trend in the curves of consumption. To hold our place with lime we must continue and further extend our efforts in this direction. If we consider lime as a primary material of construction or as a basic material in the industrial field we should expect that research information concerning it would keep abreast with progress in its utilization. But such has not been the case. It is our hope to set a faster pace in research activities and to refill the well of scientific information which has been all but pumped dry.

Instances of Valuable Work Accomplished

So much for the glittering generalities. Let us now see how our own research department can and does function. This is best accomplished by surveying a few specific cases of co-operation with other departments, with members, and with users. At the same time let us give some sonsideration to the lines along which this service can profitably be extended. There are a number of problems to which research has already made definite contributions, but there are almost innumerable questions yet requiring answers.

The National Lime Association Laboratories, as conceived, comprise three closely related units, namely, chemical, physical and research extension, and a three-fold function is performed in the initiation of research, in the investigation of problems suggested by the other departments, members, and consumers, and in the miscellaneous service offered manufacturers and users. This service involves routine testing, laboratory and field investigations, fundamental research, and surveys of scientific and technical literature.

For the construction department, facilities are available for testing of mortars, plasters, stuccos, concretes, sands, etc., and for

making investigations and analyses to determine the causes of certain favorable or unfavorable results obtained under various conditions. During the second half of the present fiscal year, a large number of complete chemical analyses for these purposes have been made in our laboratory. The category of substances analyzed included mortars, plasters, water, sands, brick, waterproofing materials and boiler scale.

As an example of the use of information already in existence, data which were obtained by the Bureau of Standards on 53 plastering sands were plotted and studied and the basis for a specification for a satisfactory sand for lime plaster was developed. This work will be continued; and through our construction department, co-operation with the new technical department of the National Sand and Gravel Association will be maintained.

Construction Problems Being Studied

Construction problems on which data are being obtained and on which further work is outlined include: A systematic and thorough study of the how and why of the effects of lime in concrete; lime in concrete exposed to sea and alkaline waters; acoustics of lime plaster; fire tests on lime plaster at average temperatures to supply the required data on its ability to retard small fires; lime and lime-cement mortars below grade; freezing of lime mortar; physical and chemical properties of stuccos. Unquestionable information on these subjects must be had if our field men and our salesmen are not to feel unsafe or entirely at sea in their efforts.

Much of the data gained from investigations on construction problems will be applicable in the field of highways, but there are additional problems peculiar to that department. Soils, for example, must be tested before treatment in order to determine the effects of lime and the proper application, and types not yet encountered must be studied. This relatively new line of activity will undoubtedly uncover many questions which research alone can answer. No better illustration is available of the practical aspects of research than the results of the investigations on lime in asphalt which have been in progress over the past three years. Such question as "Does lime produce the same effects as other fillers?", "How much lime is necessary?", and "What are its advantages and what are the economies?" were answered only by long and tedious research. We are near the end of this, and approaching the promotion stage, for it appears that as a result of the studies made by the Asphalt Association we are about to discover a measure for the amount of lime required.

The last of the above questions suggests what is probably one of the greatest and most practical services that our department can contribute. We refer to the questions of economy and the problem of determining relative costs. We know that in most of its uses lime must compete with substitutes; and even if we have clearly demonstrated its satisfactory functioning we have yet to prove its economy. In many of its uses, particularly in the industrial field, this is an intricate problem, and an answer can be found only after a very careful, painstaking and accurate survey and study of several operations and factors. In the glass industry, in metallurgical processes and in the sulphite pulp industries, for example, we have made little progress because we do not have this cost information. Such surveys can be made only by men familiar with the technology of the particular processes and industry, and who at the same time are thoroughly trained in the technology of lime. This requires research extension men who will be in a peculiarly favorable position to get this valuable information. Research must answer two questions, viz.: "Will it work?" and "Will it pay?"

Industrial Field Offers Many Problems

In the industrial field the number of research problems is legion and any attempt to enumerate them here would be useless. We can only touch the peaks. In connection with causticizing and the paper industry, for example, we have countless riddles. What properties of the limes determine the settling rate of carbonate sludges and how can this settling rate of sludges be accelerated? How can rates of reaction be improved and efficiencies increased? In connection with such problems we are utilizing not only our own laboratory and the fellowships which have been established to study these questions, but we are also co-operating with the users and with outside interests such as equipment manufacturers and consulting laboratories. Our own work has shown, for example, that greatly improved time efficiencies are obtained by previously slaking the limes and indicating a probable advantage for continuous processes. The fellowship work at Massachusetts Institute of Technology on the solubilities of limes has developed and demonstrated the principles involved in reactions, such as causticizing, in which lime functions. A series of tests of a number of limes made by an equipment manufacturer has clearly demonstrated the existence of two decidedly different types of limes in respect to settling rates of sludges and has pointed out avenues for improvement of equipment and procedure.

A TYPICAL example of our service to both producer and consumer is the co-operation which we recently gave a paper mill chemist in checking the analysis of his lime supply and in helping him to determine the cause of the low efficiencies obtained with his particular lime. The difficulties have apparently been straightened out and the lime manufacturer still holds the business which he was on the point of losing.

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Here we also encounter the problem of sludge disposal or utilization and of lime recovery. Efforts are being directed toward the development of attractive outlets for carbonate sludge in order not only to divert it but also to remove one of the chief objections to lime and thus to make causticizing, recausticing, and caustic recovery much more attractive. One of the competing materials in this field has recently become so cheap, owing to certain economic and industrial conditions, as to make it attractive to users on an equivalent basis and to constrict or eliminate our previous margin. This condition of course necessitates the improvement of lime processes either directly by increase of efficiencies or indirectly by development of income-producing by-products. Our research agenda includes both.

Appreciable lime tonnages are being lost in the field of gas absorption. Why? Because in the conditions obtained in many instances lime has been found cumbersome and inefficient. Recent work in our own laboratory and by our fellow under Professor Haslam has pointed out possible ways not only for improving the lime used but also for modifying the conditions of its use so as to overcome these objections.

Further Study of Trade Wastes

In the field of trade wastes definite information on the possibilities for the use of lime has been sorely needed and we have more or less concentrated on this problem during the past year. One of our fellows under the direction of Professor Withrow has been stationed for different periods in three different industrial plants where he has actually applied lime to the plant effluents and has worked out the optimum conditions for satisfactory results. Sugar, strawboard, and pickling liquor effluents have thus been covered.

Creamery wastes have been studied by the headquarters staff and other problems have been attacked under co-operative arrangements. The treatment of laundry waste waters is being studied by an equipment manufacturer and work to date shows that lime is effective. The work of the men under Professor Withrow, who has been directing most of our investigations along these lines, has attracted the interest of certain boards of health in the possibilities of lime and private industries and other state boards are manifesting an active interest. This interest is rapidly extending to sewage treatment

problems in general and we believe we are not too optimistic in expecting the development of numerous possibilities in this direction. Our task just now is to obtain accurate information regarding the effects and possibilities of processes using lime in connection with each individual waste or type of waste so that we will be in a position to recommend a definite procedure for each specific case. We are confident that this field is one of our most fertile ones not only for demonstrating the value of research but also for immediate tonnage possibilities.

In the natural course of our contact with plant and research laboratories and with the technical literature new uses are being continuously brought to light. As a raw material and intermediate in the process industries lime is finding rapidly increasing and diversified applications. In the production of pectates, caseinates, tungstates, etc., new products and new fields are being opened up. In the "fine arts" we have such new and unique uses as illustrated by the lime spools for hair waving; and in the food industry its application in the treating of egg albumen before drying, in the fillers for fireless cookers and the so-called chemical thermos bottles.

An example of the unexpected value of data of a more or less theoretical nature is found in a recent request for information as to a possible source of supply of hydrate of a certain exceptionally high specific gravity and apparent density. It happened that lime could be used in this process only if it possessed this particular density and it also happened that we could furnish just the information desired and thus saved the day.

Information on physical properties, such as particle size, apparent density and specific gravity, is also necessary in considering the use of hydrate as a carrier for insecticidal dusts and our data have been used as a guide in tests conducted at a state experiment station on airplane and mechanical dusting for control of insect pests. The use of lime as an admixture and carrier for insecticides has increased rapidly, partially, we believe, owing to the proven uniformity of the material, but largely owing to the fact that specific data on its various properties are available. The warning of the probable increase of cotton boll weevil this year, recently issued by the Department of Agriculture, foreshadows a further increase this season in the demand for lime not only as an admixture but also as a raw material for calcium arsenate. Preparations for tests on mosquito control by airplane dusting are also under way and opportunity will be offered for a first-hand study of the physical requirements of lime for this purpose.

One of the rather interesting and important recent developments in the technology of lime which we believe may largely be attributed to the far-reaching effects of the research interest in lime is the publication for the first time, in the current edition of the Official Methods of the Association of Official Agricultural Chemists, of a section on soil liming materials.

G. J. Fink

In the course of all of this work which we have hurriedly surveyed and in all that completed and in progress, which we cannot mention separately, it has, of course, been necessary to devise and revise physical and analytical methods. Co-operation in the nature of comparative tests has been given the American Society for Testing Materials and some of the methods of lime analysis, both physical and chemical, will be published in the A.S.T.M. proceedings.

As stated in previous annual reports, we consider the development of specifications for lime a very necessary activity and in this connection this year efforts have been made toward a concentration of this activity in Committee C-7 of the American Society for Testing Materials. The conservative attitude of this organization and its unquestioned recognition in the industries as the national sponsor for specifications for materials makes it the logical body through which to direct work. Through its representative membership of scientists and technologists, both producers and consumers, it also affords a most valuable and satisfactory medium for certain types of co-operative research. In the face of the increasing agitation and demand for specifications, the tendency has been and we believe will continue to be toward consolidation and unification with consequent reduction in actual number. A classification of uses is gradually being worked out on the basis of the functions of the lime, and specifications applied accordingly. Progress along this line is slow, however, owing to lack of information as to the relations between the properties of the limes and the way they function. Here again we are called upon for more research data.

WE are thoroughly convinced that shortly the differences between limes will be understood and that requirements for industrial uses will be so definitely known that each and every lime will be properly allocated to its best use, as a result of which quality will always be considered before price.

The scientific, technical and trade periodicals carry in almost every issue articles of importance to all our interests. These contain data and information which should be used, and we conceive it as one of the duties of the research department to direct this material as such to the proper department, to members or to users or to abstract it and present it in a usable and easily assimilated form.

Through the membership letter the attention of the manufacturers is called to interesting articles and by means of the press releases of the publicity department and through the Agricultural Lime News Bulletin and direct correspondence the more important facts are given wide distribution. The response to most of these items has been quite favorable as indicating a genuine interest in this rejuvenated material, lime. The increasing requests from schools, colleges, universities and industrial and consulting laboratories for information and co-operation are exceedingly gratifying. The publication last summer of a list of lime research problems in one of the journals of one of the scientific societies brought a large number of inquiries and requests for suggestions concerning co-operative research and as a result several new investigations have been started.

Lime Gets Increasing Publicity

As concrete evidence not only of the success of such activities in arousing interest in lime but also as proof of the publicity value of a research organization may be cited the increasingly large number of articles which have appeared in the technical, scientific and trade journals during the year. The fellowships have yielded nine articles in different journals. The co-operative investigations have produced eight and there were sixty other articles not directly traceable to association activities but nevertheless indicating the trend of interest.

The rapidly increasing use which is being made of this technical literature by lime manufacturers and salesmen and by users and investigators may be considered a favorable index of increased appreciation of lime, and the 50% increase during the past year in the number of lime plants employing chemists indicates the increasing desire to improve products and to sell service. We are thoroughly convinced that shortly the differences between limes will be understood and that requirements for industrial uses will be so definitely known that each and every lime will be properly allocated to its best use as a result of which quality will always be considered before price.

Temperature Control in Magnesia Production

Northwestern Magnesite Company Uses Rotary-Kiln Process for Both "Dead-Burned" Magnesia and Plastic Magnesia

DEAD burned magnesia is used for the lining of steel furnaces in the basic open hearth steel process. Before the war practically all that was used was imported. During the war, when importation was impossible, domestic production was developed on a large scale, but it declined when importation began again. A tariff on imported magnesite has allowed the industry to continue at a reduced rate of production, and one of the principal producers of dead burned magnesia in the country is the Northwest Magnesite Co. of Chewelah, near Spokane, Wash.

Recently this company has turned its attention to producing plastic or caustic magnesia for which there is a wider market. Plastic magnesia is made from the same rock, the difference in manufacture being in the degree of heat that is applied and the length of time of burning. Dead burned magnesia is burned at the temperatures used for burning cement clinker, 2800 to 3000 deg. F. Plastic magnesia is burned between 1100 and 1400 deg. F. In dead burning the finished product shows "no loss on ignition," in plastic burning there is a loss on ignition varying from 5 to 10% by weight. Plastic magnesia is used for stucco and for flooring.

The plant of the Northwest Magnesite Co. does not look much different from a cement plant and the process used much resembles portland cement manufacture. Since only the degree of heat differs in making dead burned magnesia and plastic magnesia, the plant will serve to make one as well as the other.

Crude magnesite looks like limestone and it is a carbonate of magnesium as limestone is a carbonate of calcium. The Northwest quarry is 5½ miles from the plant and is connected to it by a tramway. Being in a mining country, it is locally called "the mine," although quarry practice is followed.

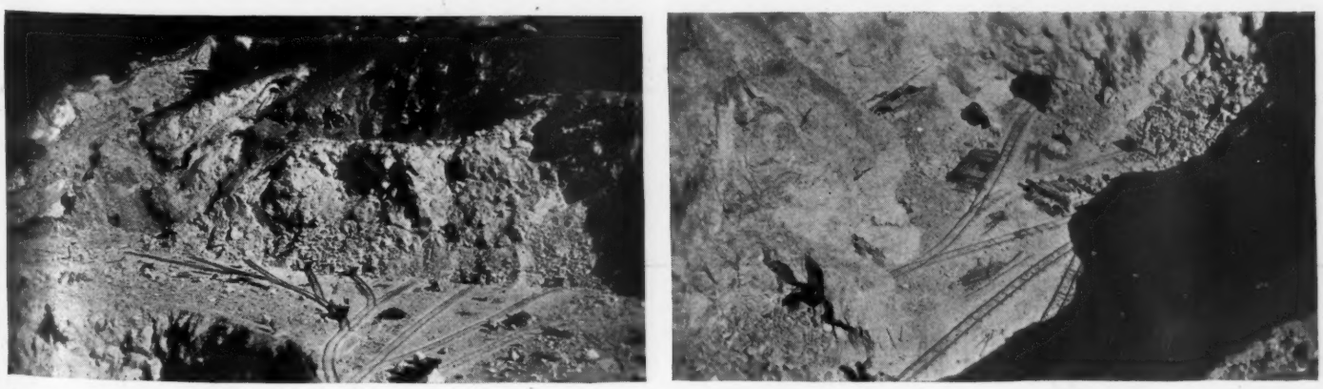
Washing and screening plant at the Chewelah, Wash., quarry of the Northwest Magnesite Co.

The quarry practice is to put down holes 12 to 30 ft. deep with Denver rock drills of the hand-operated type. These holes are chambered and then loaded with 30 and 40% du Pont gelatine. The men space the holes and vary the load according to the rock that is to be broken.

The broken rock is loaded by hand and trammed to the mouth of a "raise" down which it is dumped. This raise acts as a bin for car loading. The bottom is connected with a tunnel in which is a track over which horses pull the cars to the washing plant.

Here the rock is broken in a 16x24-in. Traylor jaw crusher and sent to a Link-Belt scrubber where water is added. From the scrubber it goes ot two No. 5 Gates gyratory crushers in closed circuit with a trommel screen having 2½ in. round holes; the undersize goes to tramway loading bins.

The aerial tramway is of the type developed by the Riblet Tramway Co. of Spokane, and is one which is considerably used in mining operations both in this country and South America. The buckets each hold 1100 lb. and are drawn over a standing cable by a traveling cable. On reaching the terminal at the plant the buckets are automatically detached and are pushed by hand to a point above a bin where they are dumped. This allows the bin to be filled evenly throughout its length. The empty bucket is pushed around to the outgoing rope and held until a bell rings when a final push attaches it automatically to the rope and sends it on its way. The bell is rung by a friction on the cable drum and its purpose is to insure even spacing of the buckets on the line.



Left—Magnesite quarry face. Right—Looking down at the mouth of the raise into which the broken rock is dumped

From the tramway bin the rock goes by a 20-in. conveyor, which is beneath the bins, to the crushing plant. It is first fed to a 42-in. Allis-Chalmers roll which breaks it to ½-in. From the rolls it goes to Colorado Iron Works impact screens. The oversize goes back to the same roll and the undersize to a second 42-in. roll which breaks it to 10-mesh. Impact screens receive the product and send the oversize (plus 10-mesh) back to the same roll.

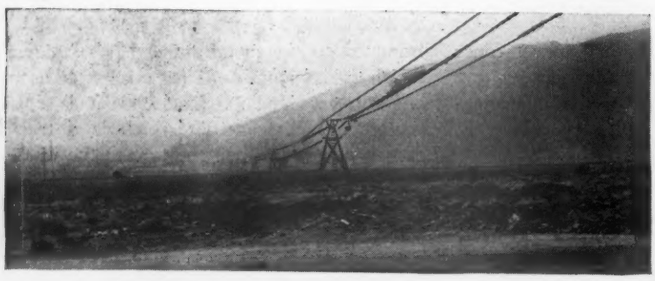
Dead-Burned Product

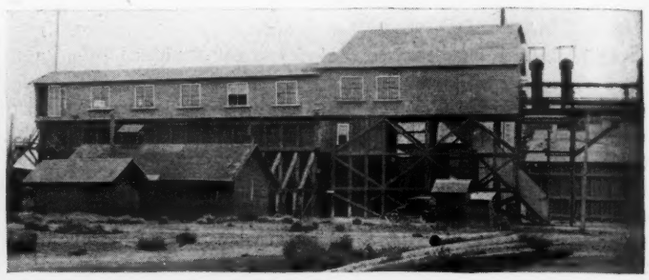
The greater part of the crushed material is much finer than 10 mesh. Coarser rock has been burned but the 10-mesh crushing has been arrived at as the most economical for dead burning.

After passing the 10 mesh screen the magnesite is conveyed to bins from which it is weighed out and iron ore added.

A small amount of iron is necessary to hold the magnesite together in making furnace lining. The ore used in this plant is a magnetite containing about 80% of iron oxide. It is ground in a Fuller mill so that the greater part passes a 65-mesh screen and added to the magnesite at the rate of 50 lb. to the ton.

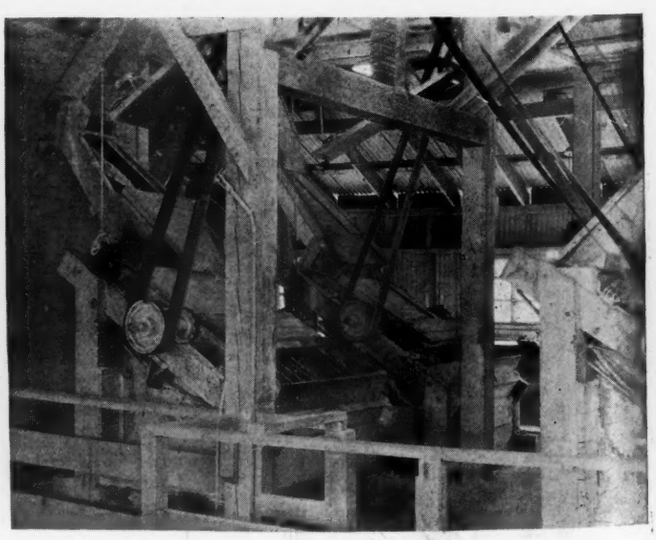
After the addition of the iron the magnesite is elevated to the kiln bins ready for burning. A storage bin is provided so that the kilns may be kept running in case of a





Left—Tramway between quarry and plant. Right—The receiving terminal of the tramway from the quarry

Left—Interior of the receiving terminal. The operator is pushing a bucket out on the return cable. Right—The cylinder (left) is an oiling device which is run over the line occasionally to keep it in condition



Left—One of the two sets of 42-in. rolls used to crush the magnesite before burning. Right—Impact screens which are in series with the crushing rolls

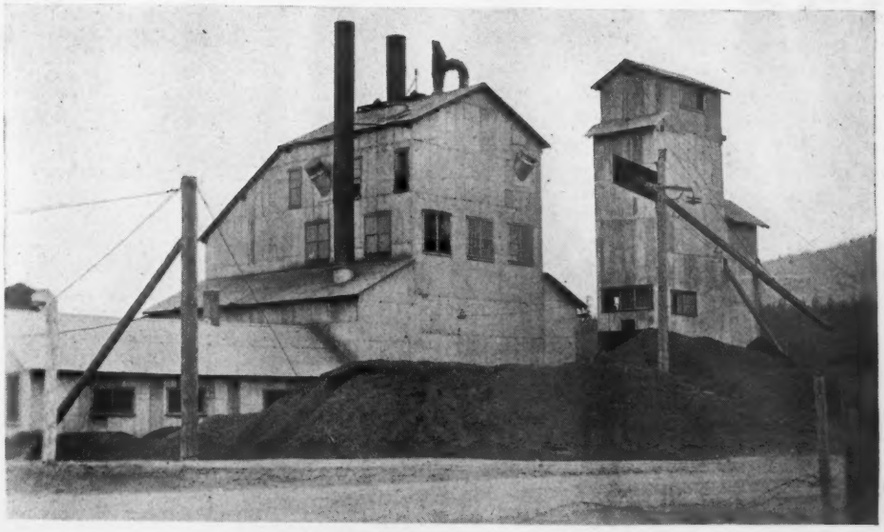
shut down of the crushing plant or the conveying system.

There are six kilns of the bottle-necked type, 7 ft. and 7½ ft. diameter and 120 ft. long. They were made by Musser and Son, Allentown, Penn. They are lined with refractory blocks 6 in. thick. These blocks take on a coating of magnesia after a little use and this protects them from further corrosion.

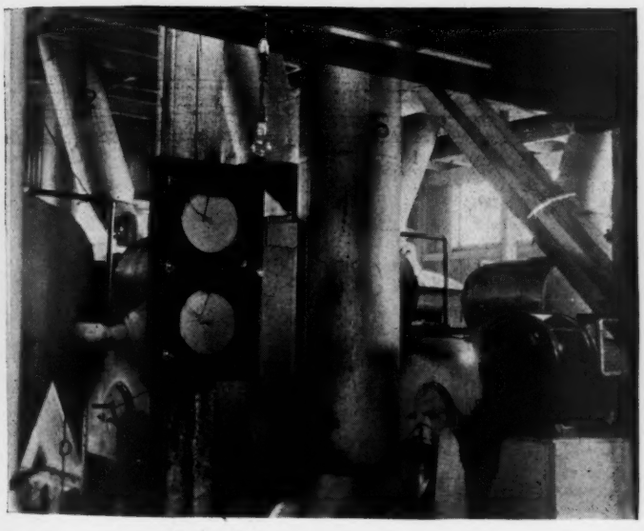
Pulverized Coal System

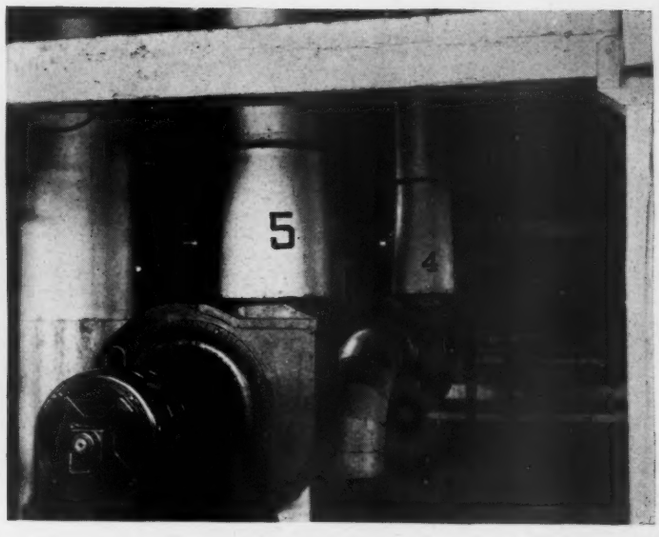
Powdered coal is used for firing and the system used is that of the Bonnot company. It is a return system in which the powdered coal circulates through a main and back to a storage bin as gas or water might circulate. Taps along the main permit the coal to be drawn off and burned at any point.

The coal is received at about 1-in. size and finer and fed to roll pulverizers of a peculiar design. From these it is exhausted by fans

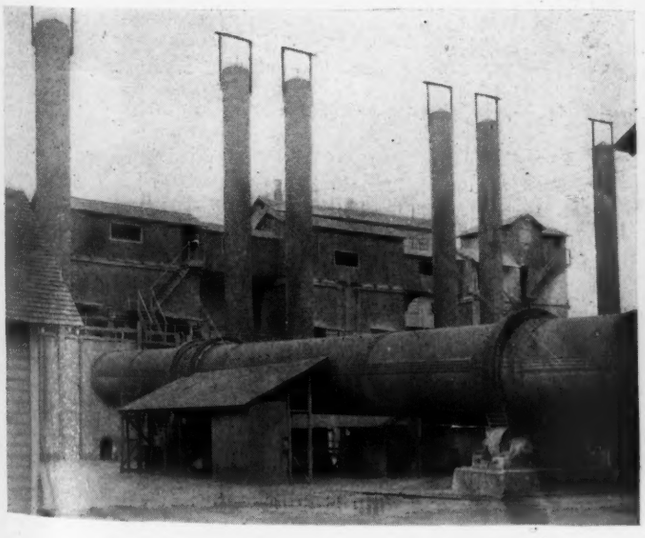


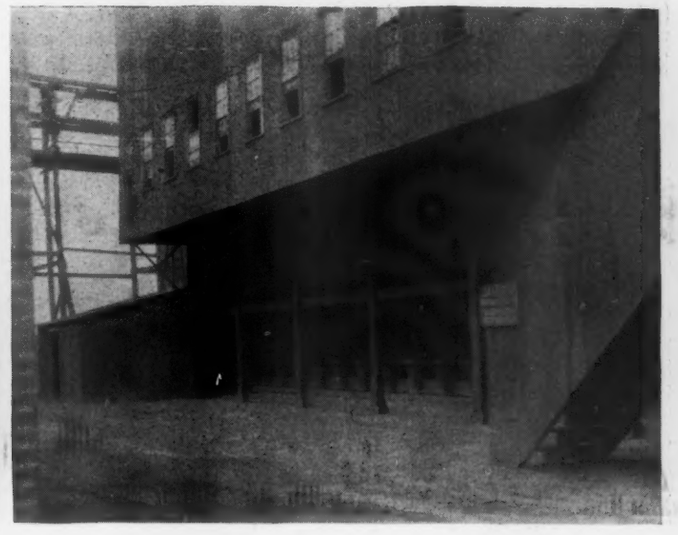
Plant in which coal is pulverized





Left—Interior of the coal pulverizing plant. Right—Exhaust fans used to lift pulverized coal from crusher to bins





Left—One of the six 120-ft. kilns. Right—Bins under the precipitation house in which dust is collected

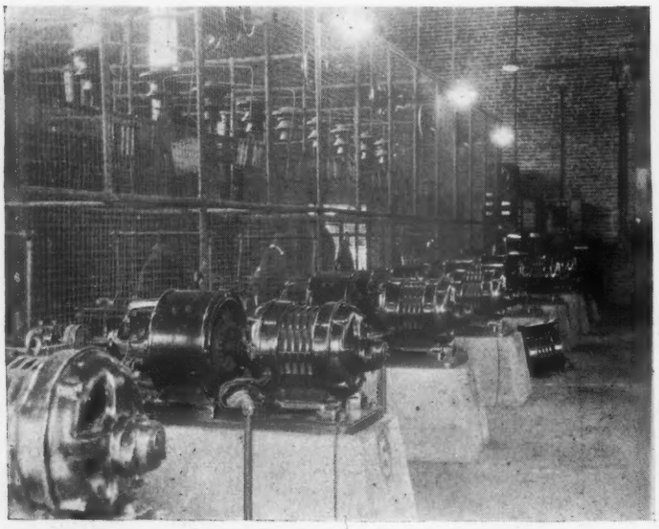
and lifted to the powdered coal bin. Each crusher has its own exhaust fan. Other fans furnish the air which forces the powdered coal through the pipes and back to the bin. Before reaching the bin the coal and air pass through a separator which removes the excess air.

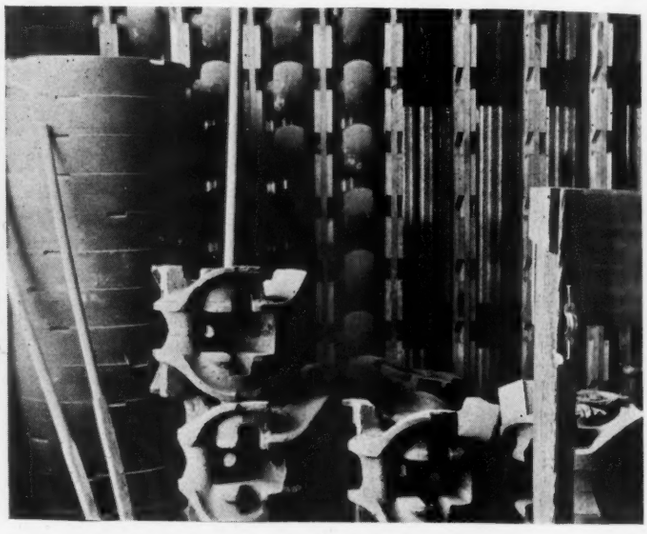
Electric Dust Precipitation

The kilns are connected to a Cottrell precipitating plant which collects all the dust. It is housed in a large building at the end of the kilns and it contains the dust catching equipment and bins and conveyors for storage and removing the dust. The motor-generators for supplying this current are in a separate building.

These generators send a 220-volt current to transformers which step it up to 100,000 volts if required, although a lower voltage is generally used. The high voltage current is rectified by a revolving plate rectifier. This changes it from an alternating current to a direct pulsating current. It is carried out to the precipitation house and into chains which are hung in tubes. The tubes are grounded. The static effect of this high tension current causes the dust to adhere either to the tubes or the chains and at intervals these are rapped automatically so that the dust is dislodged and falls to the bins below. The current of air from the kilns, freed from the dust as it passes through the tubes, then goes out of the building. The dust removal is so complete that not a trace of dust can be seen escaping with the air.

A part of this dust is included in the product and a part sent to waste. It is carried to the waste dump by a stream of water.





Left—Motor generator sets, transformers, and rectifiers that make the high tension current used to precipitate the dust. Right—Spares for the coal pulverizer showing the rotor which holds the rolls, the rolls and the tires

Left—Boarding house and bunk house at the quarry. Right—Company office and laboratory building

The burned magnesia is sent through coolers, which are shorter editions of the burning kilns and then to the storage house. Here it is broken to about ¾-in. size by a set of rolls and sacked for shipment.

Plastic Magnesia

For burning to plastic magnesia one of the kilns has been fitted with a combustion chamber in which the powdered coal is ignited and partly burned before the flame enters the kiln. A recording electric pyrometer has also been attached so that the heat can be carefully watched and controlled.

Extensive tests and experiments show that the temperature must be carefully controlled between 1100 and 1400 deg. F. To accomplish this with a rotary kiln, at these comparatively low temperatures, is a genuine operating problem.

The plant uses electric power throughout.

Report of Committee on Peat in Canada

CANADA has had a thorough investigation made of the possibility of using its peat bogs as a source of fuel and the final report of the Peat Committee just issued gives the result of the work. It is a 300 page book, excellently printed and well illustrated, and it is more than a book on peat, for it gives whatever has been done in utilizing peat in any part of the world.

Some of the committee's experimental production was used for burning lime at two kilns in Ontario. Peat and brown coal, which does not differ much from peat, are now regularly used for lime burning in Germany. Peat may have some possibilities in some parts of the United States where coal and wood are scarce. Working on a commercial scale, Canadian peat was cut and dried for $3.57 per ton. But it is a low grade fuel.

New Plant Makes Sand-Lime Brick From Pure Silica Deposit

Modern Factory of the Lakeland Brick and Tile Co., Lakeland, Fla., Has Unique Features Worked Out by the Operators

THE plant of the Lakeland Brick and Tile Co. of Lakeland, Fla., was erected in August, 1925. It has functioned perfectly from the first, and the demand for its product has been so great that the entire output of the plant is taken as fast as it is made. Not only in Lakeland, but in all the surrounding towns one sees piles of this snow-white brick before buildings that are under construction.

The sand from which the brick is made is a very pure silica sand. Analyses have shown it to contain as much as 99.6% SiO_2. It would make an excellent glass sand if a market were available, as it is practically free of iron.

Uses 60 Tons of Sand a Day

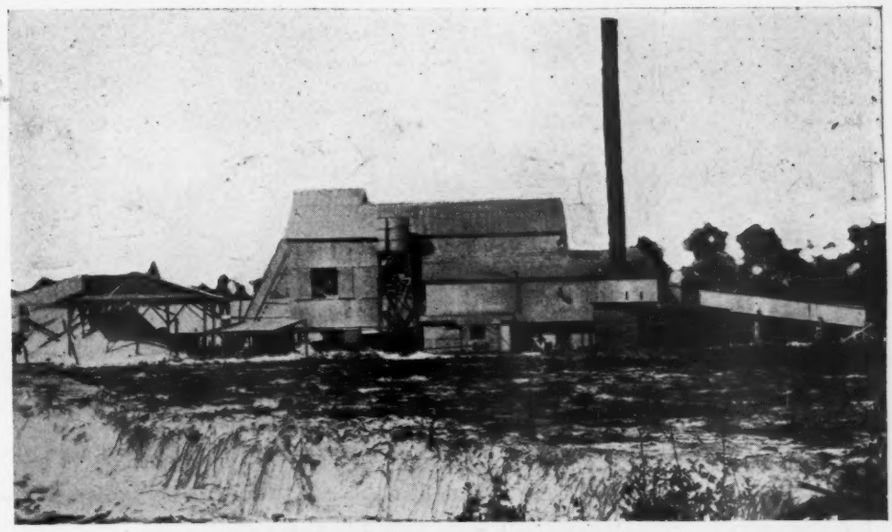
The sand is dug from a pit at the plant, about 60 tons per day being used. The deposit is 13 ft. deep and about half of this depth is below water. At present a Green ½-yd. scraper bucket is used, but when operations are carried below water level it is expected that a pump dredge will be installed. There are no coarse particles in the deposit and the only screening necessary is that required to remove palmetto roots and trash from the top soil.

The sand is washed in a washer which was built at the plant. It consists of a series of flights working on a chain in a box which flares at the top to give a considerable settling area. The sand is brought out fairly dry. It falls on a conveyor belt which rises at a rather flat angle which takes it to a stockpile under a shed roof. The sand drains well, but in wet weather it sometimes does not dry sufficiently to be used by the time it is needed.

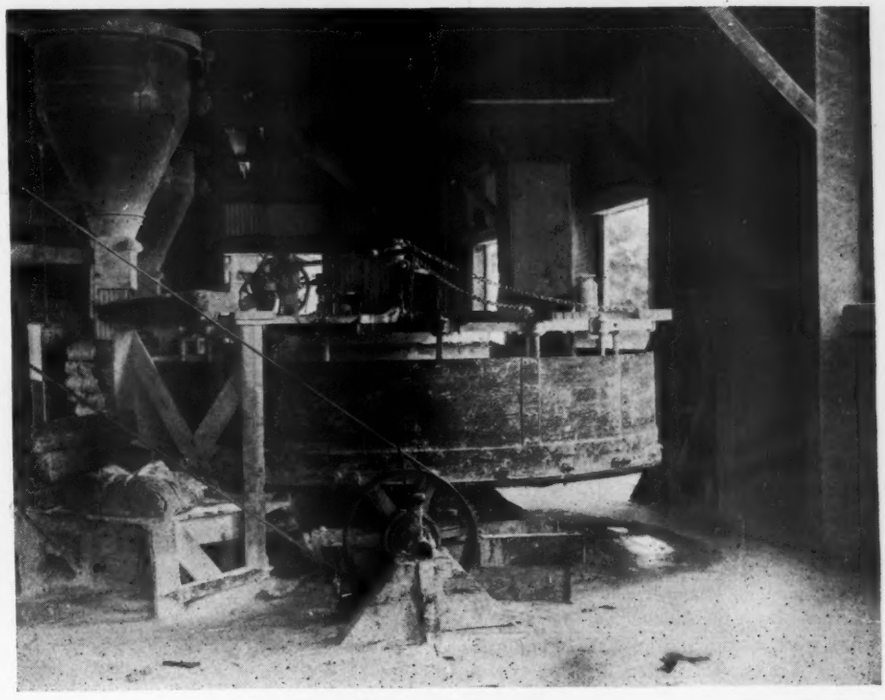
Ordinary Lime Hydrators Are Used for Mixers

The sand is raised by an elevator to a cross conveyor which puts it in the bin from which it is taken to the two mixers. These are ordinary Clyde hydrators. Above the hydrators are weighing hoppers for both sand and lime, but these are no longer needed. It is much simpler to fill the mixer with sand to a mark and then add the hydrated lime by sacks. As these are filled to a constant weight the proportions of lime and sand are always correct. The use of lime hydrators for mixers is unusual, but they function very well for the purpose, and the plant superintendent said that he liked them fully as well as other kinds of mixers with which he had had previous experience.

The lime hydrate used preferably comes from one or the other of the Ocala, Fla., companies. Of late, owing to the strong demand for Ocala lime and the difficulty of getting rail shipments of any kind through, other limes have had to be substituted. That which was being used while the plant was visited came from the Alabama Lime Co. of Birmingham, Ala.



Lakeland Brick and Tile Co.'s plant



One of the two hydrators used as mixers

Sand is excavated by a scraper bucket. It is almost pure silica and white as snow

As the plant was originally designed, the hydrators were to serve the double purpose of hydrating burned lime and mixing, and the equipment is ready to use them in that way. But the use of hydrate makes the operation simpler and gives a more uniform mixture.

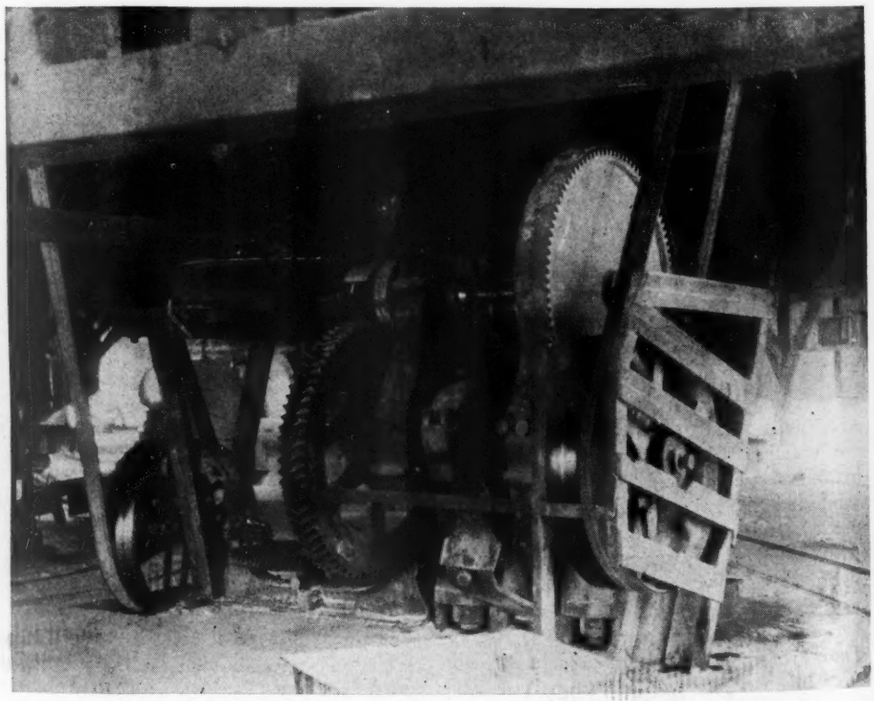
From the mixers the lime and sand are sent to two 12-mold brick presses, made by Jackson & Church, of standard type. The green brick are piled on cars to be run into the curing cylinders. There are three of these cylinders, one made by the Erie Engine Works, the other two by the William Bros. Boiler and Manufacturing Co., of Minneapolis, Minn. All three cylinders are of the same size, 80 ft. in length and 6 ft. 6 in. inside diameter. Each cylinder holds 25 cars and each car holds 1000 brick.

Brick Find a Market as Rapidly as Manufactured

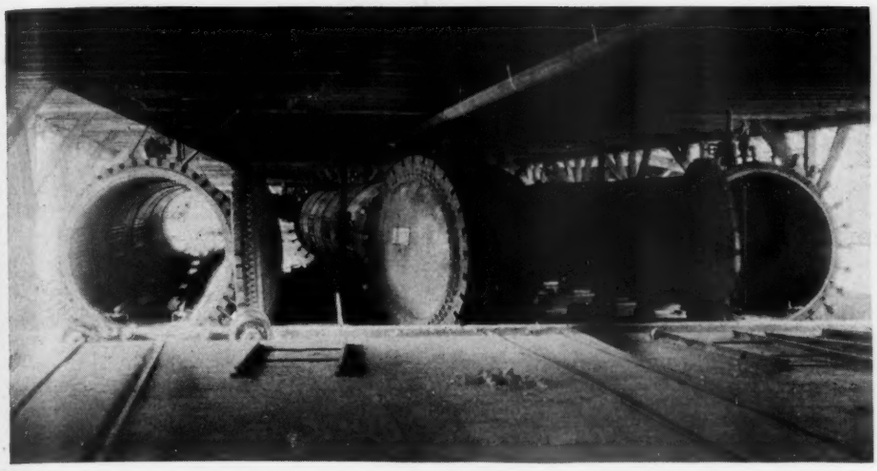
After curing, the cars are pushed through the cylinder to a storage shed which is 240x65 ft. The storage shed has never had a chance to be used as the brick are taken away as fast as they are made.

The plant is steam-driven and oil is used as fuel. Both the boilers and the main engine were made by the Erie Engine and Boiler Works. The boilers also supply steam to a hoist made by the National Hoist Co. of Harrison, N. J., which pulls the scraper bucket that digs the sand. A second scraper bucket that draws the sand from distant parts of the stockpile to the elevator that takes it to the plant bin is driven by a Novo gas engine and hoist.

The plant is situated seven miles from



One of the two brick presses at the plant of the Lakeland Brick and Tile Co., Lakeland, Fla.



Three curing cylinders, each of which is 80 ft. long and 6 ft. 6 in. in diameter and holds 25,000 brick

Lakeland just beyond the village of Galloway. The main offices are in Lakeland. C. W. Cadwell is president of the company, W. T. Barry is secretary-treasurer, and T. H. McArdle is vice-president and general manager. The superintendent at the plant is John Nick.

Colored Products Also Made

Beside the white brick which forms the greater part of the output, the company makes a very handsome buff brick, using a permanent pigment to give the desired color. Both of these colors fit very well into the types of architectural design followed very largely in residence and other construction in Florida. Just at this time a plant such as this which uses local materials has an immense advantage in the Florida building field.

Possibilities in the Lime Industry

DESPITE the comparatively rapid advance of the lime industry during the past decade or so, consequent upon its more extended use in many directions, it is nevertheless true that, except in a few cases, the lime manufacturers of this country have shown too conservative an attitude towards new processes, the adoption of which would give fresh impetus to the industry. Apart, however, from such practical devices as are already available, signs are not wanting that experimental work now being carried out by keen scientists will at no distant date open out new possibilities which will result in a notable expansion of the business of lime manufacture. For these possibilities to be fully and properly exploited, however, it will be necessary for those engaged in the industry to seize the opportunities as they occur, and to follow with energy and enthusiasm the way pointed out to them by the theorists. —*The Stone Trades Journal*, London, England.

Artificial Marble from Gypsum

MARBLE cement is a product similar to gypsum plaster, but rendered harder than the latter by double burning and the addition of alum. Artificial marble made by means of this cement lends itself to the quick and inexpensive manufacture of various articles, to which a very pleasing exterior can be given. The process of manufacture, nevertheless, requires skill and a knowledge of the different natural marbles, and it is best learnt by practicing with samples of the latter. The process consists in spreading the cement flux over a polished surface of glass, copper, celluloid, etc., which communicates its evenness to the cement. Wall surfacing is usually made 10 mm. thick and about 1 mm. square. Veining is obtained either by adding the necessary color to the cement by careful manipulation or by tracing previously with a pencil charged with cement of the required color on the molding plate. In the latter method some artistic skill is needed to represent faithfully the natural veining. After five hours' hardening the slabs are taken off the plates and placed vertically in a place having a temperature of 16 deg. C. where they are left a sufficient length of time for the water in the cement entirely to evaporate. When a fine polish is required for the slabs the latter are tooled and treated just like natural marble; however, this extra polish has to be given immediately the slabs are taken from the plates, when they are not completely dry. *Baumarkt, Berlin, Germany.*

Curing cylinders are in a shed between manufacturing plant and storage space

"Eckels' Index" and the Modern Conception of the Constitution of Portland Cement

THE EDITOR—We wish to call your attention to one statement in our recent article entitled "Proportioning Cement Raw Materials," appearing in your June 12 issue, which through an unhappy association of ideas tends to create an incorrect impression. We refer to our use of "Eckels' Index" in connection with the statement that the formulae mentioned represent the modern conception of the constitution of portland cement clinker.

As a matter of fact, this formula, as well as Newberry's, was brought out a number of years ago, and while much good cement has been and probably is still being made by its use, it does not really represent the constitution of portland cement as we now think of it in the light of present-day research.

It was our intention in using this index to show the method employed in passing from a formula to practice rather than to comment on the constitution of portland cement, a subject of too wide scope to have been incorporated in the article mentioned.

This index would indicate that portland cement is composed of tri-calcium silicate, and *di-calcium* aluminate, while the work of the U. S. Geophysical Laboratory and the Bureau of Standards indicates that the chief constituents of well-burned portland cement clinker are tri-calcium silicate, di-calcium silicate, *tri-calcium aluminate* and several unidentified compounds as minor constituents.

We trust that you will publish this by way of correction of any false impression that may have been created by our unfortunate use of this formula.

WILLIAM A. ERNST,
Rapid City, S. D., June 29, 1926.

The Effect of Sulphides on the Properties of Blast Furnace Slag Cements*

Strengths of Cements Increase in Proportion to Sulphide Content

By Richard Gruen

THE sulphur content of blast furnace slags comes principally from the coke that is employed in the smelting process and is increased most markedly when the roasted pyrites are added to the ores that are to be smelted. Due to the great importance that is assigned to slag cements today in the cement industry it appeared to be of interest to study the influence of the sulphide content on the properties of the slags, all the more so as today the working-up of cheap roasted pyrites is common practice. The often asserted disadvantages of the action of the sulphide content on the rust-protection that is afforded the steel reinforcing in concrete can hardly be omitted as an important factor in this connection.

In order to explain the influence of the sulphide in the following, different natural and synthetic slags are melted with increasing quantities of calcium sulphide and for comparative purposes with calcium oxide and magnesium oxide as well and the melting point as well as the microscopic and hydraulic properties of the melts thus obtained were determined.

In a comprehensive work on the "Influence of the Chemical Composition of Cement on the Hydraulic Properties of Blast Furnace Slags," Passow has described the influence of calcium sulphide. He worked with additions of this chemical up to a total of 12%, and he determined that a calcium sulphide content had the effect of increasing the reactivity of the slag without harmful, secondary effects, while the melting point of the slag was reduced. The favorable influence of the sulphide content on the hydraulic properties of the slags may be seen from the following experiments that were made on this subject.

Manner of Working

The slags or melts were finely pulverized and were melted in a furnace with or without the addition of sulphides, and after a test sample had been removed, for the purpose of making from it a thin layer of slag on slow cooling, the remainder of the molten slag was allowed to flow into cold water in order to become granulated.

The dry, ground slag was then worked up into a blast furnace slag cement by admixture with 15% of portland cement clinker and 2% of gypsum, and the cement thus obtained was broken up in the usual manner. The temperature at which the process is carried out is determined by means of the Wanner optical pyrometer and then this temperature is checked by means of the Meyer optical pyrometer.

First Series of Tests—Natural Slag or Clinker

The slag, which was known by the name of "Weser" was a normal foundry slag. It was melted in seven tests. In the first test it was melted alone, then in the second test it was first mixed with 5% of calcium sulphide, in the third with 5% lime, in the fourth test with 5% of magnesia, in the fifth test with 10% of sulphide of lime, in the sixth test with 10% of lime and in the seventh and last test with 10% of magnesia. Furthermore for control purposes another slag, known as "Alba" slag, which was somewhat richer in alumina content, was melted in admixture with 5 and 10% of sulphide of lime. The results that were obtained are given below in Table 1.

TABLE I. NATURAL SLAGS

	Chemical Analysis						85% Slag, 15% Alba-Clinker, 2% Gypsum								
									Time of Set		Strength Kg/cm—				
													—28 Days—		Melting
	SiO_2	Al_2O_3	FeO	MnO	CaO	MgO	CaS	$CaSO_4$	Beg.	End	3 D.	7 D.	W.	Comb.	Point
Weser	32.6	11.6	2.9	0.7	43.5	3.1	5.1	0.6	1:00	2:20	19	23	30	28	1270
W.+ 5% CaS	31.3	11.1	3.2	1.0	43.7	2.4	7.1	0.4	3:10	5:15	18	25	32	32	1340
W.+ 5% CaO	30.3	11.2	1.6	0.3	49.4	3.0	4.2	trace	7:05	9:40	19	24	29	30	1320
W.+ 5% MgO	30.2	11.7	2.3	0.4	45.1	6.4	4.1	trace	1:45	3:00	10	13	24	34	(*)
W.+10% CaS	29.3	10.5	4.9	0.9	40.2	2.8	10.8	0.8	7:15	10:00	25	22	27	30	1370
W.+10% CaO	28.5	11.0	2.1	0.3	51.3	2.7	4.0	....	0:25	1:10	5	15	24	37	1395
W.+10% MgO	30.2	10.5	2.0	0.5	39.6	11.4	5.6	0.2	2:20	3:20	18	20	28	39	(*)
A.	31.0	11.1	1.5	(*)	47.2	2.2	5.38	....	.....	.....	15	20	23	31	.....
A.+ 5% CaS	29.8	13.5	3.2	0.34	43.3	2.3	7.4	0.23	0:25	1:00	....	26	28	35	.....
A.+10% CaS	28.8	12.0	2.5	0.27	43.1	2.2	11.0	0.2	10:00	12:00	....	16	24	35	.....

(*) Not determined.

Notes. 1. The strength of a tension piece; the other values are the average figures obtained from two tension test samples. 2. One half glassy and one half crystalline. 3. More glassy than when slag is melted alone. 4. More crystalline than when the slag is melted alone. 5. More glassy than with 5% of lime. 6. Almost completely glassy. 7. Almost completely crystalline. 8. The particles are stronger and have a double fracture on breaking.

When the slag is melted alone and without any of the additive agents that are employed in the subsequent tests, then the melting takes place in such a manner as to give equal condition of granulation in all the slags which is, as is known, a very important characteristic of the slag as far as its hydraulic properties are concerned.

The melting temperatures are naturally increased by the admixture of calcium sulphide as by that of calcium oxide, as in either case the total lime content of the melts is increased. The microscopic examination of the granulated mass shows in the case of the sulphide-containing slags a considerably fewer number of double refractive constituents than in the case of the magnesia and particularly the lime containing slags.

A number of microscopic photographs were made of the various slags and it was seen for example in the case of the slag containing 10% calcium sulphide that there were fewer crystalline particles. The glassy particles remain dark colored. The same with 10% of lime showed numerous double refractive crystalline groups and also crystals enclosed in glassy masses.

As far as the time of setting of the cement is concerned it was found that as the sulphide content was increased the time was delayed. Increase in the magnesia content of the slag did not have any very marked effect on the time of setting of the cement.

As the sulphide content increases the strength of the cement is increased.

When the lime content is increased at first, even when as much as 5% has been added, the strength of the cement is not affected; but when the proportion reaches as high as 10%, then the initial strength of the cement is considerably decreased, because the slag has been converted into the crystalline condition.

A magnesia content of 5% lowers the strength of the cement, although the addition of this substance makes the slags more glassy than when a corresponding proportion of lime is added. When the proportion of magnesia is as high as 10%, then the initial

*Stahl und Eisen, 1925 (344-6).

strength of the cement is the same as that when no additions at all are made to the slag. The final strength figures were, however, a little higher than those obtained with straight slag cement.

The results that were obtained with "Alba" slag cement correspond very well with the aforementioned results. The hydraulic properties of "Alba" slags are influenced in about the same manner by the presence of sulphides. This also refers to the prolongation of the time of setting as well as the general increase in the strength of the set cement.

Series of Tests with Synthetic Slags

By the addition of from 5 to 10% of calcium sulphide or calcium oxide the lime content of high lime-containing slags "W" and "A" is raised to so high a point that their composition corresponds but very little to that of a normal blast furnace slag. Then again it was actually found to be no longer possible to obtain a glassy structure in the slag by granulation, which makes the slag suitable for manufacture into slag cement. For this reason, and also for the purpose of distinguishing other cases from a given composition of slag, it was thought advisable to set up a synthetic slag which had the following composition: 30% of silica, 20% of alumina and 50% of lime. This type of slag was also admixed with varying quantities of sulphide of calcium which replaced the lime content in the proportions of 5, 10 and 15%, so as to test out the effect of the addition of the sulphide on the properties of the cement made from the slag.

Thus there were made up four different compositions of slag, thus:

	SiO_2	Al_2O_3	CaO	CaS
1.	30%	20%	50%	.....
2.	30%	20%	45%	5%
3.	30%	20%	40%	10%
4.	30%	20%	35%	15%

All four of these compositions contain about the same amount of calcium oxide, but the sulphide content varied. The results that were obtained in the tests that were made with these compositions are given in the following tabulation, No. 2. These results were secured by testing the molten slags in the same manner that has been described above for the natural slags.

TABLE II. SYNTHETIC SLAGS

	Chemical Analysis				Time of Set		Strength				Melting Point
									28 Days		
	SiO_2	Al_2O_3	CaO	CaS	Beg.	End	3 Ds.	7 Ds.	W.	Comb.	
I	29.4	20.0	50.1	....	0:10	0:20	4	6	6	7	1490
II	29.3	20.3	45.1	5.0	0:35	1:05	12	13	15	14	1490
III	28.5	20.8	42.4	7.9	2:10	3:10	22	24	27	22	1480
IV	27.8	20.4	34.8	16.5	1:50	2:45	28	27	34	36	1460

In the case of sample No. 1 the granulate was half crystalline, and the pieces of slag were coarsely crystalline (the eutectic). In the case of sample No. 2 the granulate was more glassy than in the first case and the lump slag was more finely crystallized than in the first case and this applied as well to samples No. 3 and 4. Sample 2 had dendrites of calcium sulphide, and the same was true of sample No. 3, which was also turbid while sample No. 4 did not have any dendrites. Sample No. 3 in granulated form was almost purely glassy, while the last sample was full of enclosed particles in the granulated form.

As the sulphide content increases the melting point is lowered, the viscosity of the molten mass increases, however, with rising sulphide content.

The microscopic structure of the granulates is similar to that of the granulates obtained from natural slags, and again as the sulphide content increases the glassy proportion increases. Thus melt No. 4 is almost completely glassy. When the sulphide content is high the granules show enclosed substances, which is to be held as being due to the presence of the sulphide. The same characteristic structure is found very often in slags which are particularly well suited for manufacture into slag cement, and are in reality signs that the slag is of the proper quality to be manufactured into a slag cement.

Similarly the time of setting becomes longer and more favorable. The mechanical strength of the slag cement increased very sharply as the sulphide content increased.

The results agree very well with those that are obtained with the natural slag cements, but as far as the strength of the cement is concerned the results in the case of the synthetic slag cements are more favorable than those in the natural slag cements. The reason for this is that the lime content of the latter cements is too high and the effect of this is to destroy the glassy structure of the slag, but in this case such a condition does not arise and better increase in the mechanical strength of the cements is obtained.

It is also noteworthy to mention the appearance of the lump slag that is obtained in the second case. The sulphide-free melt, indicated above as No. 1, has a coarsely crystalline eutecticum which is composed of gehlenite and bicalcium silicate. The sulphide-containing melts, 2, 3 and 4, are considerably finer in crystalline structure. In the case of melt 2, dendrites of calcium sulphide are seen and regular oldhamite is crystallized out. In melt No. 3 there is seen likewise these tree-like effects and in addition thereto the entire preparation is rendered turbid. In this case the calcium sulphide content is 10%. On the other hand in the case of melt No. 4, which has the highest calcium sulphide content, namely, 15%, the dendrites are entirely absent and are replaced by drop-like separations.

Conclusion

The granulated masses are rendered more glass-like in appearance by the presence of calcium sulphide, and their mechanical strength in the cement is increased. Similarly the rapid setting of the cement has been said to be due to the presence of the sulphide in the slag, but it appears otherwise and must be laid to other causes besides the presence of this chemical. In the lump slag the calcium sulphide is precipitated and forms a eutectic with the silicates at low concentrations. Then as the temperature rises the sulphide is absorbed as a solid solution with the eutectic mixture and as a result of the cooling there are formed the mixtures in dendrite form, as has been mentioned above. When the content of sulphide of calcium is very high then separation takes place in the form of drops, as has been observed when slags contained a high percentage of manganese.

From the standpoint of slag cement manufacture no objection should be raised on the grounds that the sulphide content of the slag is too high. Quite the contrary, the presence of this chemical in the slag has a very favorable action on the properties of the cement that is manufactured from it. It is to be expected that the operator of the blast furnace will master the difficulties which arise from the presence of this chemical in the slag and which increase to a considerable extent the viscosity of the molten slag and give rise to many problems in the blast furnace practice. But as far as the eventual use of the slag for the manufacture of cement is concerned it cannot be said that the presence of even large amounts of the sulphide renders the slag unavailable for use for cement making. In comparatively smaller amounts the sulphide content of the cement gives it very favorable properties. In this fact may lie the germ of a suggestion for application of these results to common cement manufacture.

Tariff Investigation on Granite

THE United States Tariff Commission has ordered an investigation under Section 315 of the tariff act of 1922 into the costs of production here and abroad of granite now provided for in Paragraph 235 of the tariff act, at the rate of 15c per cu. ft. of rough block granite and 50% ad valorem for hewn, dressed or polished granite. The investigation will cover: "Granite suitable for use as monumental or building stone, hewn, dressed, or polished, or otherwise manufactured, and granite, unmanufactured, or not dressed, hewn, or polished."

The principal competing country for rough granite is Sweden, and for finished granite Scotland and Germany.

By far the greatest quantity of granite quarried is used in the form of crushed stone for road beds, concrete work and railroad ballast. The next largest uses are, in the order named, rough building and deep water foundations, building stone, paving and monuments. Large quantities are used for curbing, and in the form of rubble. The latter includes rough, irregular pieces sufficiently large to admit of their use for foundation work and for building construction.

Washing and screening plant of Southern Material and Construction Co., Little Rock, Ark.

Dredging Sand From Arkansas River

Southern Material and Construction Co. Supplying Large Trade from Two Plants at Little Rock, Ark.

THE Southern Material & Construction Co. is the largest producer of sand and gravel at Little Rock, Ark. It recently combined with the Big Rock Stone Co., taking the name of the Big Rock Stone and Material Co. The company does a large contracting business, not only in Arkansas but in other states. It has two yards on the Arkansas river in Little Rock, at one of which, near the city water works, is the washing plant and storage from which it makes railroad shipments, and at the other, at the foot of Ashley street, is a distributing yard for making truck deliveries in the city and a mixed concrete plant.

The sand is dredged from the channel of the Arkansas and is a well-graded concrete sand. The gravel recovery is incidental. There is gravel in abundance further up the river, but on account of the numerous bars and the low water which prevails the greater part of the year, it has not been found practical to dredge it.

The pump boat is of a type peculiar to the shallow rivers of the trans-Mississippi states in that it has the suction carried on the side instead of in front. A simple crane serves to lift it. The pump is of Morris make and it is belt-driven from a steam engine. Steamboat boilers make the steam. The dredge is supplied with gravity screens and utilizes the barge that is being filled as a settling box for the sand.

The barges are of the flush deck type with cargo boxes and as they are filled they are towed to the landing place by the steamer *Bonner*. This is a "man's size" steamboat, but it is of the shallow draft, stern wheel type of which old river men used to say that it would "float in a heavy dew." A regular tugboat with a propellor was tried at one time but it was not a success.

At the landing near the city water works, where the washing plant is situated, the barges are unloaded by a stiff-leg derrick made by the American Hoist & Derrick Co. It handles a 2-yd. Blaw-Knox bucket, which is lifted by a Clyde Iron Works 3-drum hoist with two auxiliary drums for turning the "bull-wheel" of the derrick. Power is supplied by a 100 h.p. Allis-Chalmers motor.

Plant Substantially Built

This equipment is very substantially installed on concrete foundations and the hoist is enclosed in a well-built cabin with glass front and sides so that the operator has an unobstructed view in all weathers.

The bucket discharges into a small hopper at the end of the plant conveyor belt, which has 210 ft. centers. This belt and everything about the washing plant was furnished by the Stephens-Adamson Co. and the engineers of this company designed the plant.

The bins are of 2x6 cribbing rodded through. All the washing machinery is placed on top of the bins. This includes two Gilbert screens and two sand boxes of the chain drag type.

The sand and gravel from the elevator may be thrown any one of three ways by a swinging chute. There it may be split between the screens or sent directly to the bins or to a chute which takes it to a stockpile in the rear of the plant.

The sand is washed as it is dredged so the washing plant is principally for screening. By putting fine screens on the dredge only sand is sent to the barge and this can be unloaded and carried by the belt directly to the bins for loading out at once, in cars or to the stockpile, if the bins are full. Having this arrangement is a great convenience, as the dredge may be kept busy even though there is a car shortage or no immediate necessity to load the sand. And cars may be loaded quickly by drawing from the bins and from the belt at the same time.

The storage pile at the rear of the plant has many times proven its worth in the peak of the season, for then loading can go on both from the plant and the pile. About 30,000 tons are usually carried in storage. An American Locomotive Works crane with a 1-yd. Williams bucket is used to handle the sand in and out of the stockpile.

At the yard at the foot of Ashley street the barges are unloaded by a Dravo gantry crane, which has a Lambert hoist and an Erie-Stromberg engine. The installation is steam driven and it is unusual in that natural gas is used under the boilers for fuel. Gas fired boilers are old, of course, but one does not often find them on a movable machine like a gantry crane. Gas has many advan-

tages in this case, one of them being that it saves the difficulty of getting coal to the boilers.

There are two small bins for loading trucks, one for fine and one for coarse aggregate. The coarse aggregate sold is crushed stone from the Big Rock Stone Co.'s quarry, about five miles out of town. It is brought into the yard by rail.

This same crushed stone is also used as coarse aggregate in the concrete mixing plant of the company, which stands near the yard. This is a very interesting plant, as it has been developed after some experimenting to find out the best method of handling the cement, aggregates and mixed concrete. Last year this plant produced about 26,000 cu. yd. of concrete, which is evidence that it has fully established itself and that architects and engineers no longer have the fear of using "ready mixed" that they have had in most places when it was first introduced.

R. A. Campbell, who is in charge of all operations, designed and built the plant, using only such material as was at hand and could be easily bought. In the beginning the crane was utilized to elevate both the aggregates and the cement, but it was found that this tied up the crane for too much of the time and interfered with the regular work of unloading barges and loading trucks. So elevators were put in, a small chain and bucket elevator for aggregates and a Stephens-Adamson sack elevator for the cement.

The same elevator serves for both coarse and fine aggregates, a "wing" at the top turning the discharge to either of two bins. Below these bins are Blaw-Knox batchers of the volumetric type. The threaded rods for adjusting the batchers have been taken off and wire ropes wound on a shaft substituted. The Blaw-Knox Co. now makes batchers with this adjustment. Below the batchers is the mixer, which is a regular Smith tilting mixer, No. 28-S, of the familiar type used by general contractors. After the aggregates have been run in from the batchers the cement is added from the sack. Water is measured in from a pipe. The mixer is revolved the desired time, which is never less than a full minute, and the concrete is poured into a hopper and chute below from which a truck takes it.

The trucks have a body especially adapted for concrete which is made of steel and which is 4 in. wider at the back than the front, allowing the concrete to slide out easily.

The drive of the mixer was originally by gearing, but this has been changed to a belt drive. As the motor has to set near the pulley, making the belt centers short, an idler pulley in a vertical sliding frame is used and the belt is cut long. The weight of the idler not only keeps the belt tight but gives a greater arc of contact.

The office of the company is at the foot of Ashley street in Little Rock. A. C. Butterworth is the president of the company and R. A. Campbell is in charge of operations.

Cincinnati Gets 1927 Convention of Sand and Gravel Men

Decided at Detroit Meeting of National Executive Committee

CINCINNATI, OHIO, the Gibson Hotel, January 17, 18 and 19, 1927, are the place and date of the next annual convention of the National Sand and Gravel Association. This was decided at a meeting of the executive committee in Detroit, Mich., on June 29. Earl Zimmerman, vice-president and general manager of the Ohio Gravel Ballast Co., Cincinnati, was irresistible in his persuasion and logic. The executive committee also listened to reports from the association's executive secretary, V. P. Ahern, and its research engineer, Stanton Walker. The association is in excellent condition financially, with ample funds for its present budget, and anxious to increase its membership and resources only that it may extend its activities into new fields.

Michigan Association Met with National Executive Committee

On the day following the executive committee meeting there was a meeting of the Michigan Sand and Gravel Association with the executivee committe of the National Association, and the members of the executive committee were the guests at luncheon of the Michigan producers. Speeches were made by practically everyone present, enthusiastically endorsing the work and program of the National Association. W. F. Fisher, of the Tecumseh Gravel Co., Grand Rapids, Mich., is president of the Michigan Sand and Gravel Association, and L. J. Dyament, of the Ward Sand and Gravel Co., Oxford, Mich., is secretary.

V. P. Ahern, who has been acting executive secretary since the death of T. W. Barrows, last winter, was appointed executive secretary at the Detroit meeting.

Following is the registration of producers at the Detroit meeting:

E. W. Dienhart, Acme Concrete Products and Gravel Co., Cement City, Mich.

H. H. Halliday, H. H. Halliday Sand Co., Cairo, Ill.

Stanton Walker, National Sand and Gravel Association, Washington, D. C.

V. P. Ahern, National Sand and Gravel Association, Washington, D. C.

O. E. Gooding, Standard Gravel Co., Pontiac, Mich.

J. J. Haarer, Ray Sand and Gravel Co., Detroit, Mich.

H. H. Battjes, Grand Rapids Gravel Co., Grand Rapids, Mich.

W. F. Fisher, Tecumseh Gravel Co., Tecumseh, Mich.

J. M. Settle, Ohio River Sand Co., Louisville, Ky.

J. E. Carroll, J. E. Carroll Sand Co., Buffalo, N. Y.

E. H. Perry, Lenawee Sand and Gravel Co., Tecumseh, Mich.

L. J. Dyament, Ward Sand and Gravel Co., Oxford, Mich.

L. K. Lendon, United Fuel & Supply Co., Detroit, Mich.

H. C. Ellis, Ohio and Michigan Sand and Gravel Co., Toledo, Ohio.

Hugh Haddow, Jr., Menantico Sand and Gravel Co., Millville, N. J.

H. S. Earle, President, Genesee Gravel Co., Detroit, Mich.

R. C. Fletcher, Flint Crushed Gravel Co., Des Moines, Iowa.

J. L. Shiely, J. L. Shiely Co., St. Paul, Minn.

Earl Zimmerman, Ohio Gravel Ballast Co., Cincinnati, Ohio.

Kansas Deposits of Volcanic Ash To Be Developed

THE Volcanic Ash Co. of America, supposed to be a subsidiary of the Kansas Flour Mills Corp., is now active at Anthony, Kans., getting ready to market wholesale quantities of volcanic ash products from the extensive beds two miles east of the city. The deposit is first mined, then ground and dried very much the same as is cement, and finds ready market in the larger soap-making centers. George W. Biggs, of Kansas City, chief engineer of the Kansas Flour Mills Co., has general charge of the establishment of this industry in Anthony.

Practically all of the machinery to be installed has been received over the Missouri Pacific Railroad, and a collapsible steel factory building for the plant is en route to Anthony. Among the machinery now here is a drying oven with a capacity of six tons per hour.

The concern already has orders booked that will run the plant at one-half capacity, and prominent among the users of the product is the Colgate Soap Co. of New Jersey, which is said to have contracted for several car loads each week. Most of the product will be shipped in sacks like cement.

There are several similar volcanic ash beds in different parts of Kansas. A large one has recently been discovered in McPherson county, another near Burr Oak which this company has bought, and another deposit has been found in Meade county which the Cudahy interests have bought. This volcanic ash deposit, in addition to being a valuable detergent for soap makers, is being considered favorably as a base for the making of the finer qualities of cement.

It is learned from good authority that the Volcanic Ash Co. of America will begin grinding, drying and shipping its product from Anthony July 15.—*Anthony (Kan.) Republican.*

Current Abstracts of Foreign Literature

Quick Determination of Lime in Cement Rock and Cement

This subject seems to be interesting the German chemists, as a number of articles have appeared on it, one of which was abstracted in these columns. Another article has appeared in the June 10 issue of *Zement* describing another quick method for the determination of the lime content of ground cement rock and cement itself, particularly when the latter contains blast furnace slag.

The method is as follows: Half a gram of the cement rock mixture is weighed out and made into a slime with 10 cu. cm. of water, and then dissolved in approximately 15 cu. cm. of concentrated hydrochloric acid. Then concentrated ammonia is added drop by drop to the boiling solution until the alumina and iron are precipitated in the form of hydroxides. Then the manganese ingredients are precipitated in the form of a brown mass by the means of bromine water. The solution is then boiled to expel the excess bromine and the entire mass is filtered. The filtrate is acidified with dilute hydrochloric acid, a piece of blue litmus paper being used as the indicator.

Then 25 cu. cm. of a solution of sodium acetate are added. The latter solution is made by dissolving 240 grams of crystalline sodium acetate in one liter of water. The litmus paper is turned blue again. The weak acetic acid solution is then boiled and precipitated with the aid of a solution of boiling ammonium oxalate. The latter solution is made by dissolving 42 grams of crystalline ammonium oxalate in one liter of water. The lime is precipitated as calcium oxalate. After boiling for a few minutes, the granular precipitate falls to the bottom of the beaker. It is then filtered and washed with hot water. The precipitate is then removed from the filter paper to a beaker and is mixed with 250 cu. cm. of boiling hot water and then with 10 cu. cm. of a 1 to 1 solution of sulphuric acid. The solution is then titrated in the usual manner, with a solution of permanganate. The percentage of lime is given direct by multiplication by the standard factor of the solution.

The permanganate solution is made by dissolving 17 grams of crystallized permanganate in hot water and making up to 3 liters. It is very essential that care be taken to see that the volume of the solution is exactly 3 liters. This solution is then allowed to stand for 14 days and then it is standardized against pure iron oxide. Half a gram of the latter is weighed out, dissolved in hydrochloric acid and then reduced by the addition of zinc chloride. The latter solution is made by dissolving 25 grams of the salt in 20 cu. cm. of concentrated hydrochloric acid and then diluting the solution thus formed with 200 cu. cm. of water. Thereafter 200 cu. cm. of water are added to the solution of ferrous salt along with a little mercury chloride and manganese sulphate solution. This solution is made by dissolving 67 grams of crystallized manganese sulphate ($MnSO_4 . 4H_2O$) in 500 to 600 cu. cm. of water, adding 138 cu. cm. of a phosphoric acid solution of 1.7 density and 130 cu. cm. of sulphuric acid of 1.82 density and then diluting to a volume of one liter.

The standardizing solution of ferrous salt is then diluted in a white porcelain beaker to a volume of 1 to 2 liters and then titrated with the permanganate solution. The standard of the solution can be determined from the equation $x = \frac{34.97}{y}$ in which y is the number of cubic centimeters of solution used in the titration. About 35 cu. cm. of the permanganate solution will ordinarily be required to oxidize the half gram of iron in reduced form.

The titration and preparation of the cement sample takes in all about 25 minutes, and the results are as accurate as can be expected from such a volumetric method.

Fibrous Cements

Plastic compositions containing fibers and cement, etc., are patented in British Patent No. 249,899. Fibrous materials, such as sawdust, shavings, cork, wood waste, sisal, paper pulp, etc., are mixed before or after moistening with a dry hygroscopic substance which acts exothermally when brought in contact with moisture. While the heat is still being evolved the mixture is added to cement, concrete, etc., and cast into molds.

The dry hygroscopic substance may be, for example, dry sodium hydroxide, quicklime or magnesium chloride. The fibrous material may be subjected to a preliminary treatment to reduce its tendency to change in volume with change in moisture content, such as washing with a dilute solution of alkali or acid. It may also undergo a preliminary impregnation with any suitable solution, followed if desired by treatment with a precipitating agent. Then again the dry hygroscopic substance may itself act as the precipitating agent.

For example, sawdust may be impregnated with ferric chloride solution and then mixed with flaked caustic soda. Cement and water are then added while heat is still being evolved and the mixture is molded under pressure. This process is described in British Patent No. 244,178.

Colored Cement

In French Patent No. 601,561 there is described a process for coloring cement. In this case the cement powder obtained either from clinker or from slag is mixed with the finest pulverized barium chloride and also anhydrous sodium sulphate. Then the cement mixture is mixed with water and formed into molds and thereafter dried. Organic coloring matters, lake-forming substances soluble in water, and metallic salts, can also be added to the cement mixture.

Cement from Unburned Gypsum

In German Patent No. 420,957 there is described a process for making a cement from unburned gypsum, over-burned gypsum residues or natural anhydrite. The cements are made by the addition of sulphate. In the first place the raw materials are mixed with the required proportions of acid alkaline sulphates, such as sodium bisulphate or potassium bisulphate, and then ground to a fine powder. It is also possible to use neutral alkali salts and add sufficient sulphuric acid to convert them into the acid sulphate. The mixture is not heated either during the addition of the ingredients or after they have been added. It is claimed that a cement is obtained in this manner which will set perfectly and harden well. It is also possible to use very finely ground ingredients which are added together while in a water suspension.

Cement from Fluid Slag

The liquid slag obtained from gas producers and furnaces which are fired with powdered coal is employed in the manufacture of portland cement according to German Patent No. 421,427.

Before the liquid slag is removed limestone, lime, lime hydrate, silica, iron oxide, alumina, gypsum and the like are added to it in such proportions that a composite cement is obtained. The process also provides for the burning of the cement, which can take place in a chamber adjacent to the gas producer or the furnace and which is heated by the hot gases that come from this apparatus.

Lime from Limestone and Oil Shale

Methods of mining and burning oil shale and limestone formations in Sweden for the preparation of lime. Use of ash from shale for addition to cements and substitute for clay in their manufacture. Diagrams, illustrations and tables appended.—*Zement*, 1925 (631-4).

New Kansas Quarry Enterprise

R. D. BISHOP, of the American Paving Co., of Omaha, Neb., has leased the rock quarry and crusher, at Lorning, Kans., and has a crew of about 50 men at work. Rock taken from this quarry is supplying the paving on the road between Lawrence and Topeka, north of the river.

Mr. Bishop says this is the largest single ledge of rock he has ever seen outside the mountains. It is 65 ft. thick and practically all of it passes federal inspection.

The company has established a camp for the men at the quarry.—*Bonner Springs (Kan.) Chieftain.*

Trials and Tribulations of Operating a Stone Quarry in a City

A "Hearing" of the Complaints Against the Winchester (Mass.) Plant of the General Crushed Stone Co. Was Like a Convention

THE following story is so interesting that it is given in considerable detail, not because the subject is so important, but because it furnishes a *human interest* slant on the very unromantic business of getting out crushed stone. The story is all the more interesting because the principals are national figures in the crushed stone industry, one being none other than the president of the National Crushed Stone Association. Moreover, the reporter from the *Woburn (Mass.) Times,* whose report we have "lifted," did a very good job of it, in our opinion. His story follows:

Blasting operations by the General Crushed Stone Co. were "blasted" from 45 different angles last evening, when a public hearing brought out a capacity gathering of remonstrants at the city council chamber. The anterooms, chamber itself, and corridors were crowded to its capacity by residents from Ward 2, who demand that the council use its power to protect the residences in that section. Representatives of the General Crushed Stone Co. were also present, and answered a number of questions.

Elcanna Peterson of Eastern Ave. opened the meeting, declaring that he circulated the petition, now before the council, which prayed for relief against the alleged disturbances. Mr. Peterson declared that he has a new house on Eastern Ave. and that considerable damage had been incurred because of the excessive blasting. He said that something should be done to protect the residents in that vicinity.

Royal R. Giles spoke upon the suggestion of Mr. Peterson. Mr. Giles asserted that the blasting annoyance was not a new one to the city council. He said that a few years ago the controversy followed some blasting operations at the crushed stone plant and a general public meeting was held in Ward 2 hall. He declared that none of the members of that city council knew of their rights or powers and the mayor would not commit himself. He said that the residents attended a public hearing at city hall, at which hearing they were entertained and amused by a professor who gave technical surveys on the geological construction of the land in the vicinity as far north as Davis St. The professor compared the city with a mining community, Mr. Giles declared. However, he added, that the actual findings were made by a visit to the houses during the time of a blast. He spoke of an alderman who was in one of the houses in the vicinity, and when the blast occurred, the alderman was shocked by the effects. He declared that the company has repeatedly ignored the complaints of the residents. "I admire the corporation for being powerful enough to continue its work. I respect the corporation for being able to still continue its excessive blasting in the face of continual protests before the city council, which is elected to represent the people. We asked for information. We wanted to know how the thing could be stopped. What could be done," declared Mr. Giles.

He continued by declaring that the residents did not want to put the company out of business but wanted to be recognized. Mr. Giles declared that the city council should protect its taxpayers, the source of its revenue for road construction and other improvements. He said that the taxpayers in Ward 2 should be considered in that class and their rights protected as well as the General Crushed Stone Co. He asserted that one alderman said the company provided crushed stone for the roads in the city at a reasonable price because of the proximity of the quarry. "What concession would the company make to the city after it had concluded operations here and the last blast had been made? I wonder how much they would give the city for their past favors if they decided to abandon the local plant. As I said before, I admire this company if it can get away with it, and if I might use the slang phrase, it is up to the city council. I believe they use more explosive than is allowed. I have had damage to the ceilings in my house, but I have submitted a claim. I, like the other residents, want the operations to be reduced." Mr. Giles said that the residents did not want to put the company out of business but merely sought relief from the excessive blasts.

Ald. Everberg questioned Mr. Giles at the conclusion of his talk, the alderman declaring that he was not at Ward 2 hall at the time of the controversy, declaring the subject matter was new to him as well as other members of the council and that he wanted to know every phase of it.

In reply to questions by President Curran, Mr. Giles declared that the statutory laws governing the regulation of explosives are placed in the hands of the commissioner of public safety. Mr. Giles read the excerpt from the book, reading that appointments of the fire marshal in the communities of the commonwealth. He declared the fire chief was the local representative of the fire marshal in this case.

"Like California Earthquake"

Mrs. Marion B. Springer of 32 Nashua St. addressed the council, declaring that she was not a resident of the Highland district, but she did not live too far from the quarry to feel the effects. She declared that her house has been racked and a new foundation erected twice because of the vibration from the operations. She compared the activities of the company with the earthquake in San Francisco.

Elcanna Peterson declared that his company, the Tolman-Fox Co., wanted to register an objection to the blasting activities, declaring that he has been informed by the firemen that the boilers at the plant trembled with the vibration during the blasts. He declared the condition dangerous and liable to cause a boiler explosion. He added that Mr. Stone of Thayer-Foss Co. was to be present to register the objection of that concern. Mr. Peterson said that his company employed considerable help and should receive some protection. "Some alderman declares that the crushed stone company employed 100 men, but I believe that 35 would be a nearer figure," he stated.

Thomas E. Foley remonstrated against the blasting, declaring that his ceilings were demolished from the blasts some time ago. He said that he took the case up with the mayor at that time, who told him to have the damage repaired and that the company would be compelled to pay the bill. At that time there was a case pending, and he has been unable to ascertain the outcome. Mr. Foley claimed that his wife and children were in mental fear because of the blasts and likened the explosions to bursting hot water tanks.

Mrs. H. E. Hutchings of 62 Fowler St. declared that the chimneys in her house were demolished and the chimneys seriously damaged.

Mrs. W. F. Noyes, 59 Mount Pleasant St., declared that she heard and felt the effects of the blasting. John F. Donovan of 53 Mount Pleasant St. declared that his house had been damaged and added that he did not want to put the company out of business, but believed that restrictions should be placed on the activities. Daniel E. Dixon, 5 Spring Court; A. M. Strong, 81 Green St.; James J. Hearn, 121 Garfield Ave.; Timothy E. Desmond, 7 Carter St.; John J. Devanney, 8 Sonrel St.; Patrick J. Gill, 8 Eastern Ave.;

A. M. Madsen, of Madsen St.; Charles Swanson of Spring Court; John Fowle of Mount Pleasant St., and Mrs. Shea of 12 Belmont St. all spoke, testifying to damage incurred because of the blasting. Mrs. Hearn took up the phase of personal fear, which the householders were subjected to, besides the property damaged.

Alderman McGarry Objects

Some fireworks were exploded when Mr. Giles rose and asked for permission to ask some questions, which could be answered by members of the council. President Curran undertook to answer the questions. Mr. Giles asked if a permit of any kind had been granted the crushed stone company, President Curran answering that the city council of 1913 had granted a license for a dynamite magazine or container used for the storage of the explosive. He declared the license a continuing one and does not come before the council each year. Mr. Giles further questioned as to the powers of the council in restricting blasting, to which President Curran answered that he did not know if they had any powers to actually restrict the blasting.

Mr. Giles then addressed the gathering, declaring that it is near time that the council should acquaint themselves with the proper procedure to protect the people's rights. He said that the council should not be ignorant of the methods to take such a measure, instead of having an ordinary layman, the spokesman for the residents, attempting to show them the proper course.

The remark brought a stormy defense from Alderman McGarry, who declared that "he had been grossly insulted by the remark." He declared that he is as interested in the rights of the people in Ward 2 as the spokesman and he wished to do the just thing, but he believed that in the ward two residents had not used good judgment in selecting a spokesman who would insult every member of the council.

President Curran declared that the spokesman had certainly overstepped his bounds. He declared that the council was merely sitting in judgment on a certain set of facts, and was awaiting to hear both sides when the unwarranted attack was made. He declared that the chair permitted a digression from procedure, when he allowed the gentleman to ask questions. He said that the meeting was called to get at the facts and not to allow some people to make "grandstand plays" at the expense of the city council.

Mr. Giles declared that he did not intend to insult anybody, and did not intend that his remarks should be taken in that fashion. He declared that he may have been hasty, but he has been through the case for such a long time that it is exasperating not to be able to get information.

Alderman McGovern said that he was anxious that the rights of the residents be protected to the full extent. He declared that he had been in one of the houses damaged, and had no doubt that the blasting was excessive. He said that he did not care to put the company out of business, but believed that some mutual plan could be adopted whereby both sides would be satisfied.

John Rice Speaks

John Rice, president of the General Crushed Stone Co., addressed the council, declaring that early in its quarrying activity the company expended from $6,000 to $8,000 in the repair of houses in the neighborhood for damages. He declared that the officials did not believe that the damage was caused by blasting in the first instance, but the attempts of the company to maintain a spirit of good will prompted the settlements without too much controversy. He declared that these methods became costly, and that the experiences of the company showed that one resident would inform the company that they had settled with his neighbor and his claim was equally as just. The company then decided to drop these methods. Mr. Rice said that he believed that the damage attributed to the blasting operations were caused by settlements and shrinkage of timbers, and could be found in any house in or out of the neighborhood in question. He declared that the human body is the most delicate seismograph in existence, and the least shock or vibration could be felt by the human body, but probably would not register on a manufactured instrument. He said that he has been present when blasting has taken place, and from his experiences and knowledge of vibrations he declared that many of the complaints are imaginary. He declared that he was not saying that in a spirit of criticism, but he earnestly believed that the residents were honest in their beliefs that there were vibrations, but he said that the company officials were just as earnest in their beliefs that the complaints were prompted by imaginary concussions.

Several questions were asked Mr. Rice by members of the council as to the possibility of minimizing the blast, the president declaring that the blast had been very much reduced since the present management came into power. The remark brought a chorus of "nos" from the remonstrants, but Mr. Rice persisted that they have indisputable records to prove that at one time over 4,000 lb. of explosives were exploded in a single blast, while now they never explode over 1,600 lb.

Otho M. Graves Practices Oratory But Perhaps Offends the Ladies

O. M. Graves, general manager of the General Crushed Stone Co., addressed the council, declaring that he had so many thoughts running through his mind that he hesitated in delaying the proceedings to any great length. He declared that he has made experiments in the neighborhood in a quiet way and has personally investigated alleged damages said to have been caused by the blasts. He said that he had made tests with steel rods, one quarter of an inch in diameter and as long as 15 in. He declared that he stood the rods on end, which was a difficult task in itself, and placed them in the houses and in the vicinity of the blasting operations. He said that in all his tests he has yet to find one rod which has toppled because of vibration.

Mr. Graves declared that he has seen no evidence of physical wrecks, and looking about the room, he declared the women who are complaining of physical breakdown because of the mental fear, appear to him healthy and in good condition. He said that he has been in some of the houses during the time of the blast and believed that he should not go into making any statements as to his findings. He further explained that there are no restrictions on the amount of powder to be used in a blast, but the company had cut it down in a spirit of good will, hoping to satisfy the residents. He further declared that if damage had been incurred because of the blasting operations the equity court is the jurisdiction which can decide such a question, and not the city council.

Mr. Graves was subjected to a lengthy cross-examination as to the possibility of minimizing the blast and the possible effect if the operations were moved nearer the face of the quarry, blowing out a smaller quantity than as at present. Mr. Graves explained that the company had made many experiments and believe that the present distance from the face and present amount of dynamite caused no vibration. Many of the residents asked questions, to which Mr. Graves responded. The meeting consumed considerable time and at last President Curran declared that it was not correct procedure to permit the petitioners to talk after they had the opportunity to be heard, so declared the debate had closed, but added that he would permit a question if the resident honestly believed it important.

Alderman Everberg moved that a committee of two members of the council, two residents of Ward 2 should be appointed by the chair as a committee with the mayor and city solicitor to wait on the Department of Public Safety in the matter. The motion prevailed, President Curran appointing Aldermen Everberg and McGovern, Elcanna Peterson and John J. Devanney.

Railroad Would Stop Quarry

THE National Quarries Co., Lima, Ohio, plaintiff in numerous law suits against the Detroit, Toledo and Ironton Railroad Co., has been named defendant in a $75,000 damage suit instituted in common pleas court by local representatives of Henry Ford, owner of the railroad. Ralph G. Spencer is named co-defendant in the suit.

The petition alleges that the operations of the quarries company in removing stone from a section of land which was granted to the railroad company through condemnation proceedings, has resulted in an almost irreparable loss. Since May 7, the date which the railroad company was granted the right to take the land, excavations over a section of 1.48 acres have been made and that it will necessitate an expenditure of approximately $75,000 to refill the holes, the petition claims.

National Agstone Association Holds Field Meeting

Members, County Agents and Other Guests Examine Field Tests at Ohio State University Under Tutelage of Dr. Firman E. Bear

THE accepted first principle of salesmanship is "know your line"; and certainly there could have been no more effective demonstration of the desire to learn one's line, than the recent meeting of the National Agstone (Agricultural Limestone) Association at Columbus, Ohio, June 24 and 25.

After a business session on Thursday, devoted to such routine considerations as the financing of continued research work, the entire meeting was adjourned to assemble the next forenoon in the soil-test plots of Ohio State University, where, under the direction of Dr. Firman E. Bear, head of the soils department of the university, who has directed the research work on behalf of the association for the last two or three years, the party, which was composed of both agricultural limestone salesmen and county agricultural agents, proceeded from test plot to test plot, with Dr. Bear explaining the nature of the tests and the conclusions to be drawn to date. Unfortunately the state university farm at Columbus is not a good example of Ohio farms in general, so far as soil needs are concerned. The soil has been well taken care of in times past and is in far better condition now than the average farm. Consequently acid soil conditions have to be faked by the use of sulphur. Nevertheless there is ample proof of the effect of applications of limestone in crop rotation.

One test consists of tiny plots made of typical soil from all the various soil districts of the state, and here the effect of limestone in the soil is most in evidence. None of these tests have been carried far enough to develop conclusive results as to the main objective of the association's research program—which is to determine the comparative effectiveness and economy of various finenesses of ground limestone.

A summary of these experiments is given in the following papers, which were read during the afternoon session, following a delightful luncheon given to the members and guests by the university.

Dr. Firman E. Bear
Below—Arrival of members and guests at experimental farm

Relation of Fineness to the Efficiency of Limestone

L. B. Broughton

THREE years ago through the co-operation and support of the National Agricultural Limestone Association, a study was begun by the soils department of the Ohio state university on the efficiency of limestone of different degrees of fineness for correcting the soil acidity.

Field conditions were selected for these studies and eight fields were selected, one each in Franklin, Miami, Henry, Huron, Cuyahoga, Ashtabula, Trumbull and Muskingum counties. The fields were rectangular and from 6 to 12 acres in size. Each field was divided into six parallel plots, five of which were limed, the sixth being left with no treatment to serve as a check.

The products applied in these experiments were those which are offered for sale in the state of Ohio soil amendment, the materials being furnished by certain members of the limestone association.

In all there were eighteen products applied, ranging in fineness according to the following standard materials:

(1) A material all of which passed a 3-mesh screen, containing 10% of 100-mesh material.

(2) A material all of which passed a 3-mesh screen, containing 20% of 100-mesh material.

(3) A material all of which passed a 3-

mesh screen, containing 30% of 100-mesh material.

(4) A material all of which passed a 3-mesh screen, containing 70% of 100-mesh material.

(5) A material all of which passed a 100-mesh screen.

The eighteen products of different degrees of fineness were applied in such quantity to correct one-half of the initial soil acidity and in such ratio to produce the same effect the first year.

The soils of the eight fields had an average lime requirement of 6666 lb. of calcium carbonate per acre. Thus applications were made equivalent to 3333 lb., or one-half of the initial soil acidity.

The following tabulation gives the mechanical distribution of the separates, making up the eighteen products, together with the weight of each material applied, to produce the same effect the first year. (The *surface area* of the limestone applied is theoretically the same in each application.)

Mesh No.	Sample No.—	Per Cent 1	2	3	4	5	6	7	8	9
3		.....	.....	.....	.....	.....	.....	.....	.....	.....
4		.....	.....	.....	.....	.....	.....	.....	.....	.....
6		.....	.....	.....	.....	.....	.....	.....	1.80	3.50
8		.....	.....	.....	.....	.....	.....	1.00	5.80	5.90
10		.....	.....	.....	.....	5.00	5.40	8.18	9.00	10.90
14		.....	.....	4.40	4.40	7.80	9.40	12.00	7.00	10.00
20		.....	.....	6.40	6.40	7.40	12.80	11.80	7.80	11.54
28		.....	.....	5.40	6.40	5.00	12.00	7.40	5.40	9.54
35		.....	.....	5.40	6.40	6.00	12.00	6.00	5.00	11.54
48		.....	3.40	4.00	5.00	6.10	7.90	4.40	3.80	8.10
65		.....	5.00	3.80	4.80	8.00	6.90	4.00	2.80	5.10
100		.....	8.40	7.40	8.40	10.00	6.00	4.00	2.00	4.50
150		10.00	8.40	7.40	8.40	8.00	4.00	3.90	1.40	3.50
200		15.00	9.40	11.40	10.40	6.00	2.80	3.90	1.30	2.50
B		75.00	65.40	45.00	40.00	30.70	20.80	33.42	41.90	13.38
Weight applied per acre		3333	3666	3832	3932	4232	4566	4866	5666	6032

Mesh No.	Sample No.—	Per Cent 10	11	12	13	14	15	16	17	18
3		.....	.....	.....	.....	.....	.....	.....	.....	.....
4		3.60	4.00	4.00	4.00	5.00	5.80	9.80	2.50	15.80
6		5.90	5.80	5.80	10.00	8.61	8.61	7.00	17.50	9.40
8		8.28	6.00	8.00	8.00	11.90	11.90	7.00	12.10	6.00
10		10.90	8.80	8.80	8.80	13.20	13.20	7.80	12.00	7.00
14		8.00	6.80	6.80	6.80	6.50	6.50	7.80	6.40	5.00
20		9.54	6.80	6.80	6.80	8.14	8.14	7.80	5.00	5.00
28		9.54	4.00	4.00	4.00	7.00	7.00	5.00	3.00	3.00
35		10.54	4.00	4.00	4.00	7.14	7.14	5.50	2.00	3.00
48		8.10	4.00	4.00	4.00	3.40	3.40	4.10	1.50	2.00
65		5.10	6.40	4.40	4.40	8.23	8.23	4.00	1.50	2.00
100		3.50	8.90	6.90	5.90	7.94	7.94	4.00	1.80	2.80
150		2.50	9.60	6.10	5.10	1.40	1.00	3.00	3.90	4.50
200		1.50	3.90	5.00	4.00	1.14	1.14	2.00	6.00	5.90
B		13.00	20.00	25.40	24.20	10.40	10.00	25.20	26.80	28.60
Weight applied per acre		6466	6666	6999	7765	8332	8532	8799	9099	10265

These fields were planned to carry a five-year cropping system, following a rotation of wheat, clover and corn.

To date two full year's records have been obtained on these field plots, consisting of yields per acre of wheat and clover, the soil acidity of each plot from samples taken in June, 1924 and 1925, and the hydrogen-ion concentration of these samples expressed in terms of pH values. (This is merely the scientific way of stating the measure of soil acidity.)

As stated above the average soil acidity of these eight fields was 6666 lb. of calcium carbonate per acre. The limestone products were applied in amount to correct one-half of the soil acidity or 3333 units.

Coarser Material More Effective

In these studies it was found that the finest grades of stone corrected 70.4% or 2346 lb. the first year and that the coarser grades corrected 80.36%, or 2678 lb., a difference of 332 units per acre, in favor of the coarser material.

These products were then applied to produce the same effect at the end of one year. In effect there is 10% difference in favor of the coarser materials. This may be attributed to the fine dust coating the coarser particles and to unavoidable errors that occur in applying limestone in such quantities as were used where the coarser products were employed.

These data would seem to indicate that the applications of the different limestone products made in these studies are relatively correct, from the standpoint of estimating the quantity of two limestone products of different degrees of fineness necessary to apply to a soil to produce a given effect in one year.

Relative to the wheat yields produced by these eighteen limestone products the first year, the finest materials increased the yield over the unlimed areas by 26.76% and the coarser grades gave an average yield of 32.15% or 5.39% in favor of the coarser products.

Contrasting the difference between the wheat yields produced by the different products with the change in soil acidity, it is noted that the wheat yield has increased in about the same proportion as the soil acidity decreased.

Second Year Results

Relative to the data on these fields for the second year, interest would seem to center mainly on the efficiency of the coarser limestone composits. The coarser materials had as a part of their makeup, varying quantities of fine material. This quantity was in no case more than one-eighth of the total limestone added. It is assumed that this fine material would be dissolved and spent in neutralizing the soil acidity by the end of the first year. With the fine material used up, will the coarser separates remaining be sufficiently effective to carry on the reaction started by the finer separates, or will these plots maintain the same reaction at the end of the second year that was found at the end of the first year period?

An analysis of the data to date reveals that the average efficiency of the finest liming materials was 70.19% in correcting the soil acidity at the end of the second year. The efficiency of this grade of fineness at the end of the first year was 70.67%, which shows that these plots have remained at about the same reaction over the second year. For the coarser materials on the other hand, it was found that the percentage efficiency had risen from 80.36 to 116.03% from the first to the second year. This rise in efficiency of the coarser materials is due to the increased weight applied and shows that the coarser separates are not only maintaining the soil reaction, but are dissolving at a rate sufficient to drive the soil reaction towards neutrality.

During the second year clover was grown on these plots and harvested to serve as a part of the fundamental data to be used in estimating the efficiency of the different limestone composits.

For the plots receiving an application of the finest limestone materials, the clover crop was increased 36.8% over the yields of the unlimed plots and 60.49% for the plots receiving the coarser materials.

Here again the increase in crop production is found to be proportional to the soil acidity corrected.

A very interesting relation was found in these data, to the end that for each per cent of soil acidity corrected there has resulted a 1% increase in clover production.

Aside from the data on the field plots the writer has one year's records on small plots located on the university farm where the same principles were followed in applying limestone of different degrees of fineness. These experiments dealt with the five standard materials listed above. These findings show that when such materials are applied in the ratio of 1:1, 1:1.15, 1:1.45, 1:1.90 and 1:2.50 that they are equal in correcting the soil reaction, and promoting crop growth. On the other hand, when such materials are applied on an equal weight basis, there was a gradual falling off in the per cent of soil acidity corrected and the crop yield as the materials increased in size of particles.

Efficiency of Dolomitic Limestone

Efficiency studies of dolomitic limestone of high degree of purity showed that dolomitic limestone was not the equal of limestone of high calcium content in its rate of action for correcting the soil reaction and crop production the first year.

Solubility studies of high calcium limestone, dolomitic limestone and pure calcite in solution of constant acidity showed that there is considerable difference in the rate

of solution of different types of limestone materials.

Three of the fields used in these studies received treatments of the same limestone products, all of which were furnished from the same base material. The efficiency of the materials on the three fields at the end of the second year was 71.90, 111.54 and 84.38% in correcting the soil acidity. These findings would seem to indicate that soil acidity for one soil is somewhat different in nature from soil acidity of another differently located area, and that there is considerable difference between these soils relative to the rate at which they will decompose liming materials.

Throughout these studies there has been found a very close correlation between the crop yield, soil acidity and hydrogen-ion index (pH) of the soil resulting from the treatments applied in this investigation. The trend of each result substantiates that of the other. The degree of soil acidity and hydrogen-ion concentration limits the productive capacity of a soil.

Leo Poorman, President National Agstone Association

Relation Between the Fineness of Limestone and Its Rate of Solution

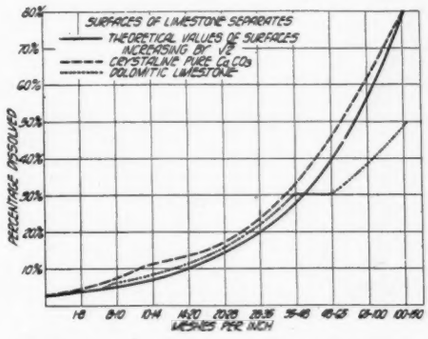
By Herbert F. Kriege

IN MAKING the screen analyses of the limestones used in this problem, the Tyler standard screen scale was used. The advantage of this system lies in the fact that the diameter of a particle passing one screen is 1.414 (square root of 2) times the diameter of the particle passing the next smaller screen. Since the area of a given weight of regular shaped particles varies inversely as the diameter of any linear dimension, the surfaces of the combined particles caught on any screen must be multiplied by this same factor—1.414—to equal the surface of an equal weight of the same material caught on the next smaller screen. If the material under consideration is homogeneous, its cleavage and fracture habits may be considered to be constant as the particles are reduced in size. If such is the case, it is possible to get an idea of the relative surfaces exposed by the several separates, even though their surfaces are anything but regular. A method of determining the actual surfaces was devised and the above assumptions made in this rate of solubility study were substantiated.

As it was desirable to know what relation actually existed between the relative surfaces of equal amounts of the same material caught on different sized screens, this method was used with satisfactory results. A fairly large piece of the stone to be studied was worked down to a regularly shaped body, one whose surface could be accurately measured with a micrometer. This piece was weighed and then shaken with a definite quantity (large excess) of the acid solution used in the previous solution study (0.150 N. HCl). At the end of 5 minutes the shaker was stopped, the solution quickly removed from the sample, which was then washed, dried and reweighed. This loss in weight then had taken place from a known weight and known surface of the limestone. Since solution can take place only at the surface of a particle, imposing similar condition of solution to other sizes of the same material will give the surface of these separates directly when equal weights are taken. This method indicates that a close relation exists through the various screened sizes between the diameters or linear dimensions and the surfaces, even of very irregular bodies. For that reason, the assumption made early in this work, that a knowledge of the screen analysis of a composite of limestone will give an index to its relative solubility in field and laboratory, is given support. Recently a method quite similar to this appeared in a report from the British Portland Cement Association, the surface of silica sand particles being determined by their loss in weight in hydrofluoric acid.

A typical example of the surface determination will be found in the accompanying chart.

The factors of greatest importance to the rate of chemical recations, such as limestone dissolving in an acid solution are acid intensity, surface exposed to reaction, and temperature. Thus, if the conditions of acid intensity, temperature, etc., are kept constant, the rate of solution of limestone in an acid solution will be governed by the amount of surface exposed. Side reactions and diffusion effects must be under control also.



Typical example of surface determination of limestone

Testing Apparatus

The apparatus used in this study consisted of a reaction chamber in which a saturated solution of succinic acid was kept in contact with a weighed portion of a limestone separate to be studied. The carbon dioxide liberated by this reaction was led under reduced pressure into a known volume of barium hydroxide solution whose concentration and conductivity had been determined. The precipitation of barium carbonate which resulted left the barium hydroxide solution lower in concentration and conductivity. This decrease in conductivity or increase in resistance was used as the measure of the carbon dioxide liberated and likewise the amount of limestone which had been dissolved. From readings of the resistance of the absorbing solution during the run the rate of solution of the limestone was followed. Both reaction chamber and conductivity cell were kept in constant temperature water baths, the temperature maintained being 25 deg. C.

The hydrogen-ion concentration (and intensity) of the reacting acid solution was kept constant by having present an excess of the crystalline succinic acid. In addition, the solution was buffered with an amount of calcium succinate greater than that which would be formed from the reaction during a run. That the variation was very slight during a determination can be seen from the following hydrogen-ion concentration values taken before and after a run was made—3.24 and 3.27 pH. As calcium succinate is soluble to the extent of 1.29 g. per 100 c.c. at the temperatures maintained, there was no danger from side reactions from this source entering into these solubility rate determinations.

Solubility Proportional to Surface Exposed

The results indicate that the rate of solution is directly proportioned to the surface exposed, and hence inversely related to the particle size. In a number of instances it was noted, however, that the rate of solution of the grosser particles was greater than would be expected from theoretical considerations. The most logical place to look for causes for these differences is in the limestones themselves. As limestones are not pure chemical compounds, nor yet minerals, we may expect chemical heterogeneity and various associations of minerals which may affect decidedly the rate of decomposition of these minerals under carefully controlled conditions. Thus with limestones of considerable magnesium content, and this constituent is always present, we

might expect a disintegration of the particle due to selective solubility of its constituent minerals rather than the regular solution as of a unit homogenous particle. Just this thing was observed in several instances. A large particle in contact with an acid solution was seen to disintegrate into a number of smaller particles, thus offering new surfaces to the reaction. Since most of the material used for agricultural limestone in this state and elsewhere contains considerable amounts of materials other than calcium carbonate, it was thought advisable to gain some information on the association of these minerals and their effect on solution of the limestone.

Solubility of Limestones Containing Magnesia

In a limestone containing magnesium, this element may be present as the double carbonate of lime or magnesia dolomite, or may disseminate through the material as the uncombined $MgCO_3$. As both occurrences have been cited by mineralogists, the state of this constituent must be determined for the limestone under consideration. From the optical properties such as the index of refraction one would be led to believe that the association of these minerals is analogous to solid solution. Increments of one constituent in the other would have a regular progressive effect. It has been observed that an increase in the index of refraction follows quite closely the increasing content of magnesium in a limestone. However, in this association down to the unit particle one would expect little if any selective solubility to be observed, since the intimacy of association would suggest simultaneous solution. This selective solubility has been encountered frequently in this investigation, and of such definite extent that its possibility cannot be doubted. Let two examples suffice to illustrate this point. Weighed samples of a high magnesium limestone were subjected to successive acid washes, equivalent quantities of 0.205 N. HCl and of 0.0501 N. HCl being used. At definite time intervals the solutions were filtered and the residues returned to another portion of the original solution. The successive washes were analyzed for their content of $CaCO_3$ and $MgCO_3$, with the following results:

Solution	$\frac{CaCO_3}{MgCO_3}$ ratio	$\frac{CaCO_3}{MgCO_3}$ ratio
A	2.289	2.509
B	1.641	1.563
C	1.495	1.253
D	1.297	1.255
E	0.898	1.178
Combined	1.487	1.269
Original	1.256	1.256

In another case the materials examined were suspended in baskets made of glass rods constructed so that the particles smaller than 10 mesh could fall through. In the bottom of the beaker was a mixture of carbon tetrachloride and ether into which the particles formed by the disintegration of the larger pieces could fall and escape further solution. The solvent again was dilute HCl, 1.10 N. Upon analysis of the solution and the residue which was caught in the organic liquids below, these values were obtained:

Ratio of $\frac{CaCO_3}{MgCO_3}$	in Solution	Residue	Original
	5.019	1.201	3.47

It is hardly surprising that definite breaks in the solubility curves to be discussed later were apparent. The solution of the more easily soluble cementing material freed the less quickly soluble constituents to pass into solution at their own rates.

Effect of Impurities

In several cases, microscopic examination revealed the presence of iron in the form of pyrite. It was rather surprising to note that in the presence of considerably larger quantities of $CaCO_3$ and $MgCO_3$, which we usually consider much more readily soluble than pyrite, this iron compound dissolved to such an extent that appreciable coatings of ferric hydroxide were formed at the surface of the limestone particles. It is not improbable that a limestone quite high in iron or alumina in a soluble form may become so coated by the precipitation of these as hydroxides as to protect the particle from further solution. In the soil, where diffusion is particularly slow and the products of reaction cannot move away rapidly, this effect may be expected frequently.

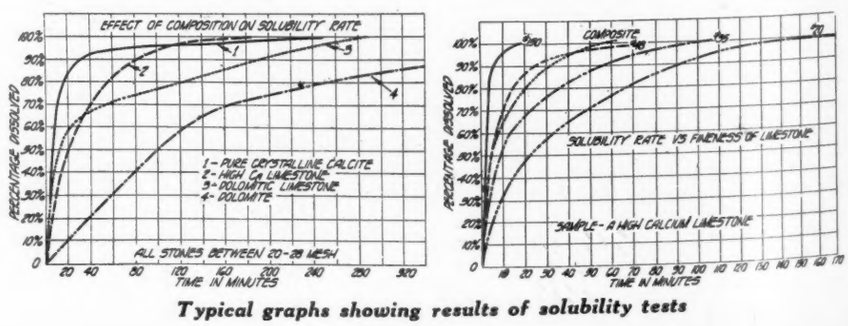
The method suggested by Karsten and modified by Vesterberg for determining the calcium and magnesium minerals in a limestone is as follows: A portion of the sample passing 150-mesh is subjected to a 25% excess of a 1% acetic acid solution at temperature from 1 to 3 deg. C. for some time. The dolomite and magnesite are so much less soluble than calcite that a fairly quantitative separation is made. However, some solubility of the magnesium minerals takes place. The solubility of these is *slower* rather than *lower*, as is the case with most magnesium minerals in comparison with similar calcium compounds. When applied to the limestone in this study, the test revealed differences in the combinations of the associated minerals, the more common being in the form of dolomite as an impurity in the limestone, rather than the occurrence of $MgCO_3$ alone. As a basis for the time for which a sample was to be left in contact with the cold acid, pure calcite was run simultaneously, and the reaction was taken to be complete when the calcite had all dissolved.

Since the limestone treatment of the fields and plots in this problem has been made on the basis of supplying half the total limestone requirements during the first year, a number of limestones were examined for their solution rates where the solution was reduced to half its original strength by the solution of the sample The solution which was chosen for this study was a 0.150 N. solution of HCl to which had been added enough calcium acetate to make the solution approximately 0.2 N. to this salt. During the run the change in pH was usually about 0.50 pH.

Apparatus for Determination of Solution Rates

The apparatus consisted of a six-liter flask immersed in a constant temperature water bath, both flask and bath being provided with stirrers adequate to keep liquid and solid particles therein in fairly uniform distribution. A quantity of the HCl solution was measured into the flask, to which was then added a sample of limestone sufficient to neutralize one-half the total acid present. At definite intervals, timed with a decimal stopwatch, portions of liquid and solids in suspension were drawn from the flask with reduced pressure and filtered quickly through a small Buchner funnel into a 250-c.c. graduated flask. This portion was then titrated against standard NaOH solution with phenolphthalein after the solution had been heated to just 95 deg. C. to expel most of the CO_2 present. From the amount of acid neutralized in a given time, the rate of solution under these conditions was determined for separates and composites made of these separates. As the solution remaining in the flask after the withdrawal of the 250-c.c. portions was unchanged by this process, it was possible to follow the solution through to completion for each sample taken. Two typical graphs are shown to illustrate the results obtained.

The method proved to be very adaptable to the matter in hand and offers itself as a convenient means of determining the relative solubility of an unknown limestone in terms of known materials. The disturbing effects of diffusion, temperature change, etc., have been cared for as in the previously described method. The behavior of a limestone under these conditions may be used to predict its action in the field, at least as far as relative values go. In a series of plot experiments, the ability of a limestone to correct the soil acidity under normal conditions was found to accord quite well with its solubility rate in the laboratory.



Typical graphs showing results of solubility tests

As one phase of the major problem, it will be of interest to this group to consider the results thus far obtained from the small plot experiments. These plots are located on the university farm and consist of forty-eight units, each 25 inches square, containing 200 lb. of soil and thus representing 1/10,000th acre each.

On the basis of a mathematical expression developed by Robert Salter, the limestones used in this experimental work were calculated to equivalents of 48 to 65 mesh particles. It was assumed from White's work at the Pennsylvania station that a particle of this size would completely dissolve in one year when applied in amounts to satisfy one-half the limestone requirements of the soil.

Plot Experiments

The work of obtaining the materials of these plots and of securing the proper distribution and amounts of the various limestones was done by L. B. Broughton, National Agstone fellow, 1923-24. He also did the sampling and made the analyses of the three-month and six-month periods.

In general the conditions of the experiment were as follows:

(*a*) Series 1-10, equivalent weights of high calcium *composites* calculated to produce the same effect (to neutralize one-half the total limestone requirement) during one year, the plots being in duplicate.

(*b*) Series 11-20 inclusive. Same as above, except that high magnesian stone being used.

(*c*) Series 21-32 inclusive, being high calcium stone in *separates* calculated to give the same effect at the end of one year.

(*d*) Plots 33 and 34, 29 and 30, and 35 and 36 being respectively ¼, ½ and 1/1 of the whole limestone requirement of the soil, using high calcium stone.

(*e*) Plots 42 and 43, 44 and 45, and 46 being the same as the above, using, however, high magnesian stone.

(*f*) Plots 37-41 inclusive having the same weight basis of the five high calcium stones, composites to meet the total limestone requirement of 5516 lb., having respectively:

1 = 100% through 100-mesh × 1
2 = 70% through 100-mesh × 1.15
3 = 40% through 100-mesh × 1.45
4 = 20% through 100-mesh × 1.90
5 = 10% through 100-mesh × 2.50

The weights taken were corrected for the various neutralizing powers of the several separates making up each composite.

Small plot test of sample soils from various parts of Ohio

Conclusions and Summary

The rate of solution of a particle depends upon its surface area. In regularly shaped particles the total surface exposure of a given weight of material is inversely proportional to the diameters or linear dimensions of the particles. Hence, dividing the diameter of a particle by two, doubles its surface area and doubles its rate of solution.

Since any one limestone has characteristic fracture and cleavage habits, it may be assumed that these habits will persist through all sizes to which the limestone may be reduced by crushing. Under these conditions the shapes of the particles during crushing will be generally similar. Therefore, a definite relation should exist between the surfaces and the diameters of irregularly shaped particles of this material.

It was found in this investigation that the relation between the decrease in size and the increase in surface of irregularly shaped particles of limestone upon crushing is a constant one.

It was found, further, that the rate of solution of limestone particles in dilute acid media is inversely related to the particle size.

In the soil the same relationship was found to exist between the various sizes of limestone and their rates of becoming available. The rates of solution of all sizes were materially reduced because of the slowness of diffusion in the soil.

In general, the results obtained under field and laboratory condition in this investigation support the original assumption that the rate of solution of limestone particles is inversely related to their diameters.

The rate of solution of limestone in acid media is specific for that limestone.

The physical properties, such as crystallinity and hardness, do not indicate the specific solution rate of a limestone.

The rate of solution of limestone is affected greatly by its composition, especially by its content of magnesium carbonate. In general, the higher this content the lower the solution rate, but not in direct proportion to the $MgCO_3$ content.

Certain exceptions to this general statement were found. One dolomitic limestone containing 23% $MgCO_3$ was found to dissolve more rapidly during the first half of its solution than did practically pure calcite and other limestones of high calcium content.

In this investigation the dolomitic limestones observed were shown to be mixtures of the double carbonate of lime and magnesia ($MgCO_3$·$CaCO_3$) and $CaCO_3$.

As the solution of the more quickly soluble $CaCO_3$ takes place the residue becomes enriched in its $MgCO_3$ content.

Under the microscope the residues from the partial solution of dolomitic limestones were found to consist largely of well defined crystals, showing little solution effects. The index of refraction of these almost unaltered crystals was found to be 1.68, corresponding to dolomite.

The dolomitic limestones were observed to disintegrate in dilute acids into smaller particles, thus offering new surfaces to solution. As a result, the rate of solution of the larger particles of such limestones was somewhat greater than was to be expected from their size.

In the soil this disintegration during solution was not observed. The compacting of

EFFECTIVENESS OF THE VARIED APPLICATIONS OF THE SMALL PLOTS

Plots	Application Lbs.	Equivalent Amounts 12 Mo.	18 Mo.	24 Mo.	Weight Basis 12 Mo.	18 Mo.	24 Mo.
	High Calcium			Per Cent			
1 and 2	—Comp. 1—3364	74.6	77.8	82.6	65.9	70.2	74.6
3 and 4	—Comp. 2—3820	70.2	87.7	91.0	54.4	69.6	72.3
5 and 6	—Comp. 3—4641	72.5	86.5	100.8	46.6	56.6	65.5
7 and 8	—Comp. 4—5620	79.4	92.8	100.8	43.1	50.1	54.1
9 and 10	—Comp. 5—7395	78.2	89.6	115.0	31.9	36.7	47.2
	High Magnesium						
11 and 12	—Comp. 1—2556	78.8	71.0	99.0	92.3	96.1	110.5
13 and 14	—Comp. 2—2938	70.6	80.8	80.7	71.5	83.2	83.4
15 and 16	—Comp. 3—3710	61.1	69.8	65.9	48.8	57.1	53.8
17 and 18	—Comp. 4—4855	58.7	77.3	87.7	35.9	48.3	54.7
19 and 20	—Comp. 5—6388	45.9	67.5	71.4	20.5	32.1	33.9
	High Calc. Sep.						
21 and 22	— 6-mesh—16242	22.3	55.4	42.0	3.95	10.35	7.9
23 and 24	— 10-mesh— 8536	19.4	47.4	47.6	6.32	16.85	17.0
25 and 26	— 20-mesh— 5073	34.4	67.8	58.8	19.6	40.5	41.3
27 and 28	— 35-mesh— 3373	43.9	84.4	88.8	38.1	74.8	80.3
29 and 30	— 65-mesh— 2958	59.0	93.2	92.4	59.3	95.6	95.2
31 and 32	—150-mesh— 2958	63.8	87.0	69.2	69.3	89.3	75.8
33 and 34	—1/4—65-mesh—1478	35.7	30.9	36.7	70.6	75.7	75.7
35 and 36	—4/4—65-mesh—5917	126.1	140.0	145.8	64.4	71.6	75.2
37	—4/4—Comp. 1—6705	136.0	132.0	142.3	61.3	62.6	64.7
38	—4/4—Comp. 2—6705	115.0	138.6	137.3	51.6	59.7	62.6
39	—4/4—Comp. 3—5917	89.5	98.3	103.8	45.3	50.3	53.4
40	—4/4—Comp. 4—5917	83.8	95.6	99.0	42.4	49.0	51.2
41	—4/4—Comp. 5—5917	70.5	73.2	95.5	41.7	37.5	49.3
42 and 43	—1/4—65 HMg.—1277	21.0	29.7	40.1	46.4	70.6	95.9
44 and 45	—1/2—65 HMg.—2556	29.8	45.6	67.2	35.7	54.2	80.2
46	—4/4—65 HMg.—5111	59.0	87.0	120.	34.3	51.7	71.5
Limestone requirement of check plots		6100	5720	6090	.....	.....	.....

Composites Nos. 1, 2, etc., are the same as those on p. 64 but in the reverse order.

soil particles about the limestone particle would tend to prevent disintegration.

Fineness of division is more important to magnesian limestones than to those of high calcium content for purposes of correcting soil acidity, because of the slower solubility of the magnesian material.

Greater leaching losses occur from applications of high calcium limestones than from those of high magnesium content of the same fineness.

The time required for the complete disappearance of a 48-65 mesh particle of high calcium limestone under these conditions was approximately two years.

The time required for the high calcium composite to neutralize one-half the limestone requirement under these conditions was between 18 months and two years. These applications had been made on the basis of the neutralizing effect of the 48 to 65-mesh particles. Hence, the rates at which these composites became available are in agreement with the calculated values.

The effects of the high calcium limestones separates under the same conditions vary from 42% in the 4 to 6-mesh material up to the desired value in the material finer than 48-mesh in two years.

The effect at the end of two years of 48 to 65-mesh high calcium limestone applied to satisfy the full limestone requirement is four times as great as that of the same material applied to satisfy one-fourth the total requirement.

Under the same conditions a full application of 48 to 65-mesh high magnesium limestone satisfies only three times as great a requirement as does a one-fourth application.

The efficiency of the high calcium separates when calculated on a weight basis varies directly with the fineness of the material. The values range from 4% to 70% for 4 to 6-mesh and 100 to 150-mesh, respectively, at the end of one year.

The results which have been presented from small plot, pot, and laboratory studies show that the rate at which limestone becomes available in the soil can be predicted with fair accuracy from a knowledge of the screen anlysis of the material used.

Asphalt Sales Increase in 1925

SALES of asphalt and asphaltic materials manufactured from petroleum at refineries in the United States during 1925 amounted to a total of 3,178,370 short tons, which is an increase over the 1924 sales of nearly 100,000 tons, or 3%, according to the Bureau of Mines, Department of Commerce. These sales were valued at $42,825,770, an increase over 1924 of 19%. Of the total sales during 1925, 1,206,700 tons, with a value of $15,305,760, was manufactured from domestic crude petroleum, and 1,971,670 tons, with a value of $27,520,010, was produced from foreign crude petroleum. The Atlantic Seaboard refineries held first rank as manufacturers of asphalt in 1925, their sales of 1,313,270 tons (practically all of which was from foreign petroleum) comprising 41% of the total for the United States. Asphalt for paving purposes was again the most important variety, its production registering a gain in 1925. Asphalt to be used in the roofing and waterproofing trades was second in importance, but its production remained stationary as compared to 1924.

Sales at the mine of native asphalt and related bitumens in the United States in 1925, including bituminous rock, gilsonite and wurtzilite (elaterite), amounted to 584,850 short tons, valued at $4,148,400. This is an increase over 1924 of 4% in quantity and of 5% in value. Kentucky led in the production of these materials. Of the various products bituminous rock was first in quantity and value.

Imports (general) of asphalt of all kinds for 1925 amounted to 122,162 short tons, a decrease from 1924 of 24%. Exports in 1925 amounted to 121,849 short tons, of which 89,014 tons was petroleum asphalt.

Talc for Waterproofing Concrete

THE EDITOR.—We noticed in your issue of June 26, 1926, p. 83, an article relative to a concern on Long Island which is using talc to waterproof and strengthen concrete, the name of the firm not given. My thought was to call your attention to the danger to the general word *talc* for waterproofing and strengthening concrete. We have been experimenting in this work for about four years and have been conducting laboratory experiments for over a year and a half, and have made a great many breaks. We know definitely that certain grades of talc, especially prepared, will waterproof and strengthen concretes. It increases its workability, makes it whiter, gives an increase in bulk, gives a greater resistance to heat and allows it to absorb only about one-half the water it otherwise would.

Our experiments have been conducted only with the short fibre talc found in the Gouverneur, N. Y., district, which has a hardness of about 4 and a specific gravity of 2.8. We produce four grades of talc, three of them of the 325-mesh fineness. One of these grades is for paper filler which carries a large count of unbroken fibre. Another grade is manufactured from a foliated talc known locally as scale. This has no fibre but some slip, and could be used for toilet powder purposes. Neither of these grades produce the best results in concrete, nor does the 200-mesh. The only one of our four grades that seems to fulfill the necessary requirements is our 325-mesh standard stock, which we have copyrighted under the name of "Loomite." This, however, is for the protection of the consumer as well as ourselves, as from a theoretical standpoint we are in doubt whether talcs outside the Gouverneur district would strengthen or weaken concretes, and if they would act the same as the fine materials used by Prof. Abrams in concretes and described by him in Bulletin 8, of the Lewis Institute series.

Our talc possibly has the strength of the aggregate of a great many concretes. It is ground theoretically 18.4 times as fine as the 200-mesh and possibly 15 times as fine as cement, and when added to cement dry it will not increase the bulk until between 3% or 4% by weight has been added or approximately 10% by volume. It fills the voids of the cement stopping the passage of water and at the same time giving the cement grains a better contact, which increases its strength.

We do not consider our laboratory tests conclusive, although to date the results show that the tensile strength of the mortars of some mixtures will increase by 61% by the use of "Loomite" and concretes under compression by 45%.

Our 200-mesh product is ground to pass 99% through 200-mesh, which we believe is considerably finer than cement, and the results obtained indicate that, as is takes nearly two times as much 200-mesh talc to get one-half the results in increased strength as when "Loomite" is used. In other words it acts as if one-half was fine enough to fill the voids of the cement and the other one-half acted as an extender. The fibre paper grade also seems to act as an extender due possibly to the long fibres that go through the screen lengthwise. This "scale" apparently does not have the strength necessary for the best results. Possibly the slip is detrimental also.

The advantage that we believe "Loomite" holds over the materials tested by Prof. Abrams is, inertness, fineness and a strength of its own.

It was not my intention to write you a long letter on this subject, but only to call your attention to what we believe to be a real danger, by the indiscriminate use of the word *talc* for waterproofing and strengthening concretes.

W. H. LOOMIS TALC CORP.,
By W. H. Loomis, *President.*

Gouverneur, N. Y.
July 2, 1926

Wish the Caption Were So!

THE following news item from the *Frankfort* (Ky.) *Journal* is somewhat ambiguous, but we are sure the rock products industry would rejoice if the caption were correct. It is a question only of time, anyhow, before they will "bury" it.

TRAVELING ROCK CRUSHER WILL BE BURIED HERE

The traveling rock crusher recently purchased from the Eagle Crusher Co. by the county, was received yesterday and will be unloaded from the cars and put into commission at once. It is the latest and best piece of machinery for road building yet gotten out. It will crush rock wherever found, whether in motion or standing still, and dump the crushed rock by the side of the road, ready for use and in condition to be spread upon the road at once. Those who have seen the machine in operation are loud in its praise and think it a wonder.

A Discussion of Concrete Materials

Kinds of Cement Demanded by the User Will Be Supplied—at a Price—Indefinite Definitions of Aggregates

SUPPLEMENTING the report of the recent annual convention of the American Society for Testing Materials, the following remarks by Cloyd M. Chapman, consulting engineer, Dwight P. Robinson and Co., New York City, are of particular interest to producers of concrete-making materials:

Among these proposed changes in portland cement specifications are higher strength requirements, a greater degree of fineness, a more rapid hardening, a more reliable strength test, a short-time strength test, a truly indicative soundness test. Portland cement manufacturers are awake to the desirability of these improvements and some are now taking active steps to accomplish them, at least in part. Cements are now being produced by several manufacturers which are considerably in excess of the standard strength and fineness requirements. The more generally the matter of improvement is discussed, the sooner we are likely to see advances made. What the user demands the industry will supply—at a price. The answer to the request for improved cement is the counter query: What price cement?

Perhaps the economic answer to the steadily increasing and insistent demand for a cement better adapted to certain special purposes is the production of new kinds of cement. Concrete road making alone consumes enough cement to justify carefully considering the possibility of developing a new cement possessing to the highest attainable degree those qualities most important in this class of service. Instead of trying to incorporate in a single cement all the qualities demanded by all classes of service, might it not be cheaper and better to vary the cement to suit the service?

Sand

Sand is the next most important ingredient in concrete. In fact, it would seem to some the most important, since it is probably true that in so far as quality of materials is concerned, it is the sand which causes more trouble than any other component in concrete. By that is meant that when trouble occurs on construction work, when the concrete does not set up, or any unusual or unaccountable thing happens on the job and the "trouble shooter" expert is sent for, it is the sand that receives his first and most careful attention, and more often than not, it is herein that the fault lies.

Whatever the method used in designing concrete mixes or of specifying proportions, it is necessary that the sand be suitable for the purpose. Regardless of how much leeway is given in the matter of mechanical analysis or fineness modulus, it is still necessary that the grains be clean and uncoated, that they be sufficiently hard, that the organic content be not in excess, and that it run sufficiently uniform in quality so that proportions once established may not have to be frequently or radically altered to maintain high quality in the concrete. These qualities are essential. It is also highly desirable that the sand be well graded, that the larger particles predominate. This is largely an economic factor. A well graded aggregate may be used in greater quantity per unit of cement than a very fine aggregate. This is true whether the proportions used be determined by fineness modulus, surface area, water-cement ratio, or other means. A fine sand requires more cement than a coarse graded sand, to give equal strength in equally workable mixes.

Sand Specifications

It should also be free from objectionable foreign material, that is, material not sand, such as lumps of clay, ice, etc. To insure acceptable quality in the sand, many tests have been used and many more proposed. Some of these tests have been made standard and others of equal or greater importance have not. For instance, while we have a standard test for organic impurities, we have none for hardness, or for presence of coating on the grains.

Consider hardness. It is all very well for the specifications to state, as most of them do, that "the sand shall consist of clean, hard, strong, etc., grains." How is one to distinguish a sand having grains just hard enough to be accepted from another sand having grains just soft enough to be rejected? Imagine specifications for cement which required that briquets made with the cement be "strong and hard," and which said nothing more about either strength or hardness. That is closely analogous to the present state of the commonly used specifications for sand in so far as they relate to strength and hardness.

It is true that in localities where the natural sands are siliceous it makes but little difference,—all the sands are hard and strong. But there are localities having sands quite unsuited to use in high-grade concrete because of their softness and weakness. On what basis are they to be rejected? How is their hardness, or lack of it, to be determined? We should either have a test for hardness or omit the word from our specifications.

Much the same may be said about cleanliness. When is a sand unclean? Shall we continue to specify that sand shall be clean when we provide no way of determining when it is unclean?

Soundness Tests

Then there is the matter of soundness. Some concrete must resist repeated alternate freezing and thawing year after year. To do so requires that aggregate—both the fine and the coarse—shall be able also to resist this exposure without crumbling. How shall the sand's ability to do so be proved before it is placed in the structure? It has been suggested that one or more of the following tests be used as a measure of soundness:

1. *An absorption test.* It is claimed that a sand having a high absorption capacity will not endure oft-repeated frost action, and that therefore an absorption test may be used as a measure of soundness.
2. *Sodium sulfate test.* This test, involving alternate saturation with sodium sulfate solution and drying out, is advocated by some and by others condemned as too severe, and as not having any direct relation to soundness.
3. *Sodium chloride test.* This test resembles the sodium sulfate test, but is less severe.
4. *Freezing and thawing.* This test is an attempt to reproduce natural conditions but it is difficult and expensive to make and involves expensive equipment.

Out of these tests, or some other, should be developed a reasonably reliable method for determining soundness and for rejecting unsound sand.

Of the other characteristics of sand usually included in specifications, there is an admitted or implied vagueness or uncertainty as to what is permissible, which puts the decision up to the engineer or the architect. It is commonly stated that sand shall be free from "injurious amounts" of certain objectionable constituents such as dust, lumps, soft or flaky particles, etc. This leaves the question of what constitutes an injurious amount to be determined by tests of the resulting concrete or to the decision of the engineer.

Perhaps it is better to leave these matters in a somewhat indefinite shape rather than to definitely demand certain qualities for which there is no standard method for determination.

Regarding sand tests in general, it is commonly assumed that if a given sand gives test results equal to standard Ottawa sand, it is a satisfactory sand for concrete. Many present specifications base the acceptance of the sand on such a comparison with standard Ottawa sand. There are, however, occasional cases in which such a comparison is not only useless but very misleading. Many natural sands which show relatively low test strengths in mortar mixtures, will, when combined with suitable coarse aggregate, make entirely acceptable concrete. To accept or reject such sand, therefore, solely upon a determination of its strength ratio to Ottawa sand, would be quite unsatisfactory. Such strength comparisons are, however, indicative, though not conclusive, and they will probably continue to be used by some engineers while other and better methods are gradually forcing it into the background.

Direct Tests Rather Than Comparisons with Ottawa Standard

An improvement on the Ottawa sand comparison test is offered in the direct determination of the strength of concrete made with the sand under investigation. Such tests should be made using all of the materials which are to be used on the job and mixing them in the same proportions that will be used in the work. Such a test also affords an opportunity for determining the proportions of aggregate which may be used with a given water-cement ratio, and also the strength which may be expected to result therefrom.

Coarse Aggregate

Proceeding now to the quality of the coarse aggregate, many of the remarks made above apply just as much to coarse aggregate as they do to sand. Grading is relatively unimportant. Maximum and minimum size limits are desirable and are customary. Within those limits, size has but small effect on quality. The larger the coarse aggregate is, the greater the tendency to segregate, and the less workable is the concrete, if other factors remain the same.

After size has been specified there remains no other quality for which standard methods of test have been adopted. It is customary to add a list of attributes with no method of determining them. This list is usually followed by a list of things which must not be present in "injurious amounts" but with no guide as to what constitutes an "injurious amount."

For some purposes is is of very vital importance that the coarse aggregate used in the concrete shall have certain characteristics. For pavements subjected to iron wheel traffic the coarse aggregate must be tough. A strong, hard, but at the same time brittle, aggregate is unsatisfactory. In the matter of soundness, it is probably more important that the coarse aggregate should be sound than that the fine aggregate should be.

Hints and Helps for Superintendents

Auger for Prospecting and Drilling Gravel Deposits

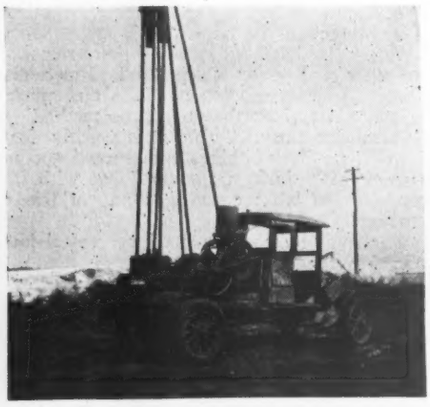
THE machine shown here is used at the pits of the American Cyanamid Co., Brewster, Fla., for prospecting for phosphate rock and drilling the ground preparatory to blasting. It was invented by the manager, Mr. Meade, to take the place of the hand augers previously used. It could be used in prospecting sand and gravel deposits where the ground contains no large pieces and especially for putting down holes in partially cemented gravel to break up the hardpan with shots of dynamite before attacking it with a steam shovel.

The auger is twisted from a flat bar in the usual way. The bottom has a cutting edge and also two teeth, which show plainly in the picture. The use of teeth

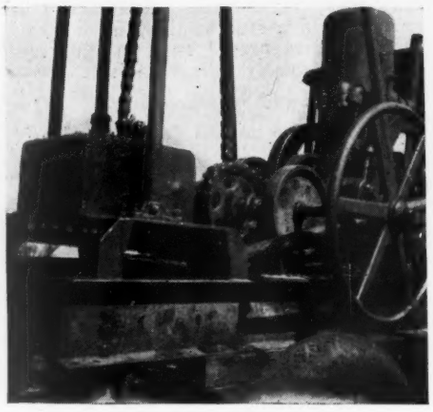
Auger mounted on truck

on one of the cutting edges was found to increase the drilling rate considerably.

The auger is fastened at the end of a square shaft which passes through a horizontal worm gear. This allows the square



The complete outfit



The drive

shaft to be moved up and down at the same time that it is being turned by the gear.

The drive is from a small gasoline engine which is mounted on the body of a Ford truck. Transmission of power from the engine to the worm and gear is by a chain and sprocket, which gives some reduction in speed.

The upper end of the square shaft is in a bearing which is carried in a frame between uprights made of pipe with braces of pipe. This has a chain attached which goes over a pulley and down to a drum on the engine. There is a clutch on this drum which allows it to be disconnected from the engine so that the auger may be fed up or down by the hand wheel which is shown at one side in one of the pictures. All the parts are mounted on a solid frame of channel irons so that they will keep in alignment.

In using the machine for prospecting, the auger is let down to the surface of the ground and the clutch disconnected so that it can force its way into the earth. It is run down the length of the twisted part and then pulled to the top either by the engine or by the hand wheel. The dirt or sand and gravel is so thoroughly compacted by the boring that it sticks in the auger, filling it full until it looks like a cylinder. A pan is slipped under the auger, which is then rapped with a stick until all the adhering material falls into the pan. This is a true sample of the hole for the length of the auger. The operation is repeated until the hole has been driven the depth required. If the auger is 4 ft. long, each sample will represent 4 ft. of the deposit at that point.

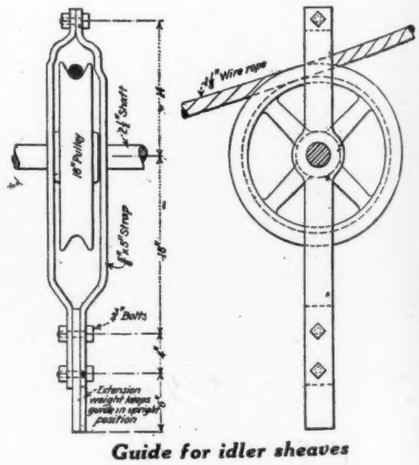
The writer has used a hand auger of the same type for prospecting sand and has found that sometimes a part of the sample dropped off when the auger reached the surface of the ground. To catch this part of the sample a pan with a hole in the center was devised, the hole being just large enough to pass the auger. This caught everything that fell as the auger was raised, and also the remainder of the sample which was dislodged by rapping with a stick.

Blasting With Water

BLASTING with water, or hydraulic pressure blasting, has not been used in the rock products industry extensively if at all. But contractors are using it to break up old mass concrete and in other places where explosives would be objectionable, so it may sometime be found profitable for use by quarries in cities. The process is simple. A pump like that used with hydraulic presses forces water in until the pressure breaks the rock. A pressure of 10 tons per square inch may be attained.

Rope Guide for Idler Sheaves

A RECENT issue of the *Engineering and Mining Journal-Press* contains a description by L. C. Moore, Hibbing, Minn., of a device for preventing hoisting ropes from jumping off idler sheaves which was successfully used at the Stevenson mine of the McKinney Steel Co. on the Mesaba range. The guide is constructed of two 5/8x3-in. iron flats, which are bored to pass over the shaft as shown in the accompanying sketch and are shaped to give a small clearance to the upper rim of the sheave. The side pieces are extended so as to bring the center of gravity of the guide below the center of the shaft. There is plenty of room for the hoisting rope to play, but the guide prevents the rope from losing the groove of the sheave. Very little wear results, as the guide is moved along the shaft by the hub of the sheave.



Guide for idler sheaves

Stripping disposed of by novel method at a silica sand plant

Pulling a Car on a Curved Track

THE "hint" shown in the accompanying picture is only one way of solving the problem of pulling a car around a curved track, but it is a simple and good way. A framework is built over the tracks and in this case it holds two vertical rollers, one for each track. As the car rounds the curve the rope strikes the rollers and its direction is changed so that the pull is approximately straight with the track. Where the curve is considerable, more than one roller is used.

The rollers are set far enough to the side so that the car passes easily.

Each roller is made in this case of a piece of 8-in. pipe, which has a plug of wood in each end. Iron pins are centered in these wooden plugs and form gudgeons on which the roller turns.

This arrangement is used at the plant of the Camp Concrete Rock Co., near Brooksville, Fla. The quarry has been recently opened and is being worked in a cut straight from the plant. As the cut is widened the tracks have to be shifted to one side and here is where the rollers come into play. Two tracks are used so that production never stops. While one track is being shifted the other is kept in service.

For pulling car on curved track

Conveyors for Removing Quarry Strippings

THE usual practice at most operations in disposing of quarry strippings is to load them onto dump cars and haul them away to be dumped. At the plant of the Ottawa Silica Molding Sand Co., Ottawa, Ill., by a clever arrangement of shovels and portable conveyors, strippings are disposed of easily and economically. At the same time continuous operation is assured.

The company uses a ¾-yd. electric shovel and a gasoline shovel of the same size in conjunction with Barber-Greene conveyors for stripping the overburden and for loading sand. On this operation conveyors have replaced dump cars. Previously the shovel loaded directly into dump cars which were pulled to the dumping trestle by an electric car puller. As may be seen in the picture, one of the shovels is loading the strippings onto the conveyor belt which discharges them over the face of the deposit worked last year. With this method a gateway is left in the face of the sand which enables the other shovel to load sand while the stripping is going on, and the conveyor system makes it possible to work into the face and behind the wall built up of strippings.

The other shovel loads from the bank into a hopper which feeds a short conveyor which discharges into the crusher. The crusher material drops onto another conveyor which feeds the car to be loaded. This is said to prove a very rapid way of handling material, as much as 30 cars per day being sometimes loaded in this manner.

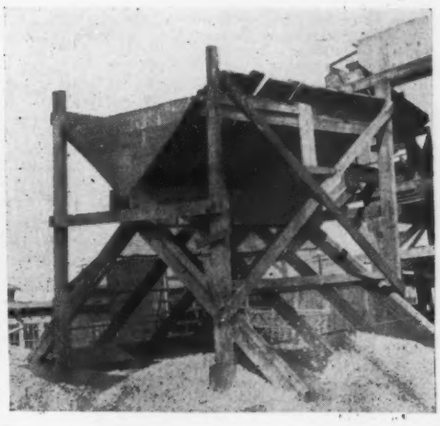
Greater mobility and economy of operation are said to result from this arrangement of conveyors and shovels. The conveyors as shown are at right angles to the track, but last year they were run parallel.

A Gravel Screen for Yard Use

GRAVEL in most of the southeastern states is sold as a mixture of sizes in many if not most places. Occasionally a car of pea gravel or of only the coarse sizes is called for and it is handy to have some way of screening it while the gravel is being loaded into the car.

The cut shows such a screen used at the yards of the Mobile Gulf and Navigation Co., Mobile, Ala. The device is of a size so that it can be picked up by the crane that is to do the loading and be placed above an open-top car. The upper part consists of a hopper into which the crane bucket feeds the gravel. Openings in the bottom of the hopper spread the gravel over the screens below. The fine gravel falls into the car and the coarse into piles on either side of the car from which it is later picked up by the crane.

The same device may be used on the ground as is shown here, making three piles of gravel, two of the coarse and one of the fine to be picked up by the crane and placed in cars.



Gravel screen for yard

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Alpha Portland Cement Co. (common)[2] new stock	June 17	100	42	44	1½% quar. Apr. 3
Alpha Portland Cement Co. (preferred)[2]	July 6	100	115	.....	1¾% quar. Mar. 1
Arundel Corporation (sand and gravel—new stock)	July 7	No par	33¾	33¾	45c qu., 15c ext. July 1
Atlas Portland Cement Co. (common)[3]	July 6	No par	45	47	50c quar. Mar. 1
Atlas Portland Cement Co. (preferred)	.....	100	.....	.....	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)[3]	July 6	33⅓	43	46	2% quar. July 1
Bessemer Limestone and Cement Co. (common)[4]	July 6	100	130	135	1½% quar. June 30
Bessemer Limestone and Cement Co. (preferred)[4]	July 6	100	106	107½	1¾% quar. June 30
Bessemer Limestone and Cement Co. (convertible 8% notes)[4]	July 6	.....	118	130	8% annual
Boston Sand and Gravel Co. (common)[10]	July 3	100	63	70	2% quar. July 1
Boston Sand and Gravel Co. (preferred)[10]	July 3	.....	.....	83	1¾% quar. July 1
Boston Sand and Gravel Co. (1st preferred)[10]	July 3	.....	.....	95	2% quar. July 1
Canada Cement Co., Ltd. (common)	July 7	100	104¼	105	1½% quar. July 16
Canada Cement Co., Ltd. (preferred)[11]	July 2	108	114	115	1¾% quar. Aug. 16
Canada Cement Co., Ltd. (1st 6's, 1929)[11]	July 2	.....	102	103	3% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944)[11]	July 2	100	93	96	
Charles Warner Co. (lime, crushed stone, sand and gravel)	July 6	No par	23	24½	50c quar. July 12
Charles Warner Co. (preferred)	July 6	100	101	103	1¾% quar. July 22
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929[16]	July 3	100	103	105	
Cleveland Stone Co.	June 21	.....	163	.....	1½% quar., June 1, 1% ex. June 1
Connecticut Quarries Co. (1st Mortgage 7% bonds)[17]	July 2	100	104	.....	
Consolidated Cement Corp. (1st Mort., 6½s, series A)[24]	July 7	.....	95	98½	
Consolidated Cement Corp. (5 yr. 6½% gold notes)[24]	July 7	100	98	100	
Consumers Rock and Gravel Co. (1st Mort. 7s)[18]	June 17	100	98½	101	
Dexter Portland Cement Co. (6% serial bonds, 1935)[22]	July 6	.....	99	101	
Dolese and Shepard Co. (crushed stone)[7]	July 7	50	89	91	$1.50 quar. July 1, $1 ex. July 1
Egyptian Portland Cement Co. (7% pfd. with com. stock purchase warrants)[21]	June 21	97	101	.....	1¾% quar. July 1
Egyptian Portland Cement Co. (common)[21]	June 21	18	20	.....	40c quar. July 1
Egyptian Portland Cement Co. (warrants)[21]	June 21	10	15	.....	
Giant Portland Cement Co. (common)[3]	July 6	50	35½	39	
Giant Portland Cement Co. (preferred)[25]	July 6	50	46½	49	3½% s.-a. June 15
Ideal Cement Co. (common)	July 7	No par	70	72	$1 quar. July 1
Ideal Cement Co. (preferred)[6]	July 3	100	107½	108½	1¾% quar. July 1
International Cement Corporation (common)	July 7	No par	58¼	58¼	$1 quar. June 30
International Cement Corporation (preferred)[3]	July 7	100	105	105	1¾% quar. June 30
International Portland Cement Co., Ltd. (preferred)	Mar. 1	.....	30	45	
Kelley Island Lime and Transport Co.	July 7	100	118	121½	$2 quar. July 1
Lawrence Portland Cement Co.[3]	June 22	100	100	110	2% quar.
Lehigh Portland Cement Co.[6]	July 6	50	85	87	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, expire serially up to 1930)[13]	July 2	100	99	100	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, expire serially from 1930 to 1935)[13]	July 2	100	97	99	
Michigan Limestone and Chemical Co. (common)[6]	July 6	.....	24½	26	
Michigan Limestone and Chemical Co. (preferred)[6]	July 6	.....	23½	24½	1¾% quar. July 15
Missouri Portland Cement Co.	July 7	25	55¾	56	25c quar. May 31, 25c ex. May 31
Monolith Portland Cement Co. (common)[9]	July 2	.....	11	11½	
Monolith Portland Cement Co. (units)[9]	July 2	.....	27	28	
Monolith Portland Cement Co. (preferred)[9]	July 2	.....	8	8½	
Nazareth Cement Co.[20]	July 3	No par	38	39	75c quar. Apr. 1
Newaygo Portland Cement Co.[1]	July 2	.....	110	120	
New England Lime Co. (Series A, preferred)[14]	Jan. 29	100	96½	99	
New England Lime Co. (Series B, preferred)[23]	June 21	100	92	95	
New England Lime Co. (V.T.C.)[22]	June 21	.....	35	38	
New England Lime Co. (6s, 1935)[14]	July 3	100	99	101	
North American Cement Corp. 6½s 1940 (with warrants)	July 6	.....	96⅜	98	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common)[19]	Apr. 8	.....	94	99	2 mo. period at rate of 7%
North American Cement Corp. (preferred)	Dec. 31	.....	.....	.....	1.75 quar. May 1
Pacific Portland Cement Co., Consolidated[5]	July 2	100	82½	83	½% mo.
Pacific Portland Cement Co., Consolidated (secured serial gold notes)[5]	July 2	.....	99½	101¼	3% semi-annual Oct. 15
Peerless Portland Cement Co.[1]	July 2	10	5½	6	
Petoskey Portland Cement Co.[1]	July 7	10	9¼	9⅞	1½% quar.
Rockland and Rockport Lime Corp. (1st preferred)[10]	July 3	100	98	98	3½% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (2nd preferred)[10]	July 3	100	.....	.....	3% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (common)[10]	July 3	No par	.....	25	1½% quar. Nov. 2
Sandusky Cement Co. (common)[1]	July 7	100	106	135	$2 quar. Apr. 1
Santa Cruz Portland Cement Co. (bonds)[6]	July 2	.....	105⅛	.....	6% annual
Santa Cruz Portland Cement Co. (common)[5]	July 2	50	82½	.....	$1 quar. $1 ex. Dec. 24
Superior Portland Cement, Inc. (Class A)[20]	July 2	42½	45	.....	
Superior Portland Cement, Inc. (Class B)[20]	July 2	20	21½	.....	
United Fuel and Supply Co. (sand and gravel) 1st Mort. 6s[27]	June 23	100	98	100	
United Fuel and Supply Co. (sand and gravel) 6% gold notes[27]	June 23	100	96	99	
United States Gypsum Co. (common)	July 7	20	159½	160	2% quar., $1 ex. May 31
United States Gypsum Co. (preferred)	July 7	100	117	118½	1¾% quar. June 30
Universal Gypsum Co. (common)[3]	July 7	No par	15	16	
Universal Gypsum V.T.C.[3]	July 7	No par	14½	15½	
Universal Gypsum Co. (preferred)[3]	Aug. 5	.....	76	.....	1¾% quar. Sept. 15
Universal Gypsum Co. (1st Mortgage 7% bonds)[3]	July 7	.....	99	(at 6½%)	
Union Rock Co. (7% serial gold bonds)[18]	June 17	100	99	101	
Wabash Portland Cement Co.[1]	Aug. 3	50	60	100	
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940)[15]	July 8	100	98½	100	
Wolverine Portland Cement Co.	July 7	10	6	7	2% quar. Aug. 15

[1]Quotations by Watling, Lerchen & Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by True, Webber & Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by De Fremery & Co., San Francisco, Calif. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee, Higginson & Co., Boston, Mass. [11]Nesbitt, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson Jr. Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hemphill, Noyes & Co., New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]William C. Simons, Inc., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25] A. C. Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York.

QUOTATIONS ON INACTIVE ROCK PRODUCTS CORPORATION SECURITIES ON PAGE 74

Editorial Comment

Publicity and Education Pay

"How the 'Open Door' Policy Wins Friends for the International System" is the title of an article in the *International Bulletin* for July, published by the International Cement Corporation, of New York City. The article states that every day is visitors' day at the plants of this great company. Last year, for instance, it is estimated 5000 people, singly and in groups, were conducted through the various plants. The article says, "Firm friends are won for International by this 'Open Door' policy."

Indeed this is the only safe policy in this day and generation, both as respects individual concerns and whole industries. The shroud of mystery can no longer be maintained about the operations of any plant, nor about the processes in the manufacture of most commodities, certainly not portland cement. To attempt to be mysterious tends to invite more competition than to be open-handed.

There was a time when portland cement manufacture was considered a mysterious process. At first it was believed portland cement could be made satisfactorily only of the natural cement rock of the Lehigh Valley. Early portland cement manufacturers in the Lehigh Valley naturally helped to foster that belief. They shipped over the entire country and abroad. In the establishment of plants elsewhere they thought they saw the loss of their natural markets.

Later it was generally passed around that good materials to make portland cement were comparatively rare, and that these comparatively rare deposits were quite generally "sewed up," by men then in the portland cement industry. Now, most intelligent men know that the raw materials for portland cement manufacture are widespread, in the United States at least, and that to attempt to "sew up" these particular natural resources is an impossible job.

It is generally recognized, too, that it is worse than useless to attempt to mystify would-be producers as to the nature of the raw materials, and of the process of portland cement manufacture. The Portland Cement Association itself has set the example of co-operative research in developing and spreading accurate knowledge of the constitution of portland cement. ROCK PRODUCTS and other technical journals of the industry have helped, as they should, and as everyone should who has the real welfare of the industry at heart.

No one can head off the schemes of promoters of new plants by mystery and inadequate and inaccurate information. Accurate information always could be acquired if the promoter sought for it in the right places—generally by breaking into the personnel of established and successful plants. The harder the job was made for him the more determined he became to defeat those who would check him. The more mystery thrown about the materials and process, the more he was able to capitalize his knowledge of materials and process.

But we can help to head off the schemes of promoters of unnecessary and superfluous projects by the "open-door" policy of education and publicity. When we have dispelled the mystery of the sources of raw materials and the processes we have made only a beginning. For when the public generally knows that deposits of limestone and clay or shale are not to be considered as a vein of gold, but as quite ordinary, every-day materials to be found almost everywhere over hundreds of thousands of square miles of the United States, the promoter can no longer use such deposits as the priceless assets of his project.

However, we must go farther in the process of education and publicity, or it will soon become far easier to manufacture portland cement than to dispose of it. Every man with a "hunch" to help promote a cement plant, or any other rock products enterprise for that matter, must be made to see the industry *as it is*—facing problems of possible over-expansion. If a promoter is establishing a plant to manufacture cement he certainly, at heart, does not want to be a party to the undoing of the industry of which he is a part, or to be a part. He either does not believe that the industry is or will be over-produced, or he is not an honest promoter. If he is unconvinced, only education through the "open-door" policy will convince him. If he is dishonest, courts and regulating governmental agencies should be capable of taking care of him, and of the trusting public.

Of course the promoter's opinions as to the future of the industry may be entitled to just as much weight, or more, than yours or ours. After all they are only opinions; but opinions to have weight should be based on facts and it is only through an "open-door" policy that facts become current and are considered in forming opinions. We are all dealing with the public, in the last analysis, although we may reach only a minute portion of it directly. If the opinions we help to spread by opening our doors to visitors and through publicity are based on fact—and fact means truth—they must by the very laws of nature eventually register with the public.

Doubtless the day will come when it will be considered the moral obligation of an industry to protect the investment of the public in that industry, so far as is humanly possible to do so. That can be accomplished only by some method of control of promotional activities, and the sooner we have such control, if it is intelligent, the better for everyone.

QUOTATIONS OF INACTIVE ROCK PRODUCTS SECURITIES

Stock	Date	Par	Price bid	Price asked	Dividend rate
Coplay Cement Mfg. Co. (common) (4)	Dec. 16	.....	12½	.....	
Coplay Cement Mfg. Co. (preferred) (4)	Dec. 30	.....	70	.....	
Eastern Brick Corp. 7% cu. pfd.) (1)	Dec. 9	10	40c	.....	
Eastern Brick Corp. (sand lime brick) (common) (1)	Dec. 9	10	40c	.....	
Edison Portland Cement Co. (common)	Nov. 3	50	7½c(x)	.....	
Iroquois Sand & Gravel Co., Ltd. (2 sh. com. and 3 sh. pfd.) (1)	Mar. 17	.....	$12 for the lot	.....	
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)	.....	
Lime and Stone Products Co. (1100 sh. pfd., $10 par and 700 sh. com., $10 par)	Feb. 10	.....	$66 for the lot	.....	
Missouri Portland Cement Co. (serial bonds)	Dec. 31	.....	104¾	104¾	3¼% semi-annual
Olympic Portland Cement Co. (g)	Oct. 13	.....	.....	£1⅛	
Phosphate Mining Co. (1)	Nov. 25	.....	1@5	.....	
Pittsfield Lime and Stone Co. (preferred)	.....	100	.....	.....	2% quar. Apr. 1
River Feldspar and Milling Co. (50 sh. com. and 50 sh. pfd.) (1)	June 23	.....	$200 for the lot		
Rock Plaster Corp. (390 sh. com., no par) (1)	Mar. 17	.....	$12 for the lot	.....	
Simbroco Stone Co. (pfd.)	Dec. 12	.....	.....	.....	$2 Jan. 1
Tidewater Portland Cement Co. (common) (3)	Nov. 25	.....	8½	.....	
Vermont Milling Products Co. (slate granules) 5 sh. pfd. and 1 sh. com. (3)	Dec. 30	.....	$1 for the lot	.....	
Winchester Brick Co. (preferred) (sand lime brick) (5)	Dec. 16	.....	10c	.....	

(g) Neidecker and Co., Ltd., London, England. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auction by R. L. Day and Co., Boston. (3) Price obtained at auction by Weilepp-Bruton and Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on November 3, 1925.

Atlantic Gypsum Products Bonds Offered

LEE, HIGGINSON & CO., Boston, Mass., are offering at 98½ and interest, yielding about 6.15%, $2,000,000 1st mortgage sinking fund 6% gold bonds, series A, of the Atlantic Gypsum Products Co. (With each $1,000 bonds there will be delivered 10 shares of common stock.)

Dated June 1, 1926; due June 1, 1941. Principal and interest (J. & D.) payable in U. S. gold coin at offices of Lee, Higginson & Co., in Boston, New York and Chicago. The Merchants National Bank of Boston is trustee.

Data from Letter of George N. Roberts, President of Company

Company.—Has been organized in New Hampshire by Bemis Industries, Inc. (a Delaware holding and management corporation), in association with Rock Plaster Corp. of New York and certain individuals, to manufacture and sell various gypsum products, chief among which are gypsum wall plasters, gypsum wall board, gypsum blocks, fibre wall board and fibre sheathing. These materials during the last 10 years have been steadily superseding lime and clay products and lumber for interior wall construction by reason of their superior strength and endurance, fire-resisting and insulating qualities, ease and rapidity of application, and comparatively low costs.

Company will acquire the entire properties and business of the Rock Plaster Corp., which, with its predecessors, has been manufacturing well-known brands of gypsum wall plasters for 35 years. This plant, occupying about 7½ acres of land, is located on the East River, at the foot of Cabot St., near 150th St., New York City, with excellent transportation facilities.

Company will also acquire substantially all the properties of the Atlantic Corp., Portsmouth, N. H., including about 65 acres of land on tidewater, containing well constructed buildings, substantially all in first-class condition, having about 550,000 sq. ft. of floor space and ample docking facilities.

The acquisition of Rock Plaster Corp. carries with it extensive gypsum quarries at Walton, on the Bay of Fundy in Nova Scotia (operated under long-term leases renewable to 1963), containing an estimated supply of more than 50,000,000 tons of high-grade gypsum rock, produced at low cost, and shipped from docks adjacent to the quarries, enabling (after certain proposed improvements are made) the use of ships of at least 4,000 tons carrying capacity each, with resulting low freight rates to the company's plants in New York City and Portsmouth. This supply of the basic raw material is sufficient for more than 100 years' operation of the company's plants, at the rate of production now contemplated.

Capitalization (after this financing)	Authorized	Outstanding
1st. mtge. sink. fd. gold 6s, series A (this issue)	$10,000,000	$2,000,000
6% debentures, due Aug. 1, 1944	1,500,000	1,000,000
7% preferred stock	5,000,000	1,000,000
Common stock (without par value)	200,000 shs.	200,000 shs.

Purpose.—The proceeds will supply a part of the funds required for the acquisition of the above properties and of additions proposed immediately to be made to plants and equipment and working capital. More than half the cost of the properties will be provided through the issue of junior securities, viz., $1,000,000 6% debentures, $1,000,000 7% preferred stock and 200,000 shares common stock without par value. The new company will receive $500,000 through the sale for cash of a part of the above stock to executives or directors of the new company.

Security.—These bonds will be secured by a first mortgage on the real estate, plants and equipment, rights, franchises, patents, trade marks, licenses, leases of gypsum and lime deposits, etc., acquired or to be acquired from Rock Plaster Corp. and the Atlantic Corp., included in the above-mentioned appraisals aggregating $4,088,373; also by a mortgage on all such properties and additions or improvements thereto hereafter acquired by the company (a first mortgage thereon if bonds of this issue are used to acquire such future properties). They will be part of an authorized issue of $10,000,000, issuable in series, the particulars of each series to be determined at the date of issue, provided that no series shall mature later than 1956 or bear interest exceeding 8% per annum.

The initial series A will be limited to $3,000,000, of which $2,000,000 are now to be issued and $1,000,000 reserved for issue not earlier than March 1, 1927.

Valuation.—The properties upon which these 1st mortgage bonds will be a first lien are conservatively valued at $4,088,373, after full allowances for depreciation.

Control.—Through majority stock ownership, is held by Bemis Industries, Inc., and its associates. The chairman of the board and the president of the new company are Albert F. Bemis and George N. Roberts, who are respectively president and vice-president of Bemis Industries, Inc. Willard P. Fuller, treasurer of the new company, is also a vice-president of Bemis Industries, Inc., and its general manager. J. C. Woodhull, president of Rock Plaster Corp., will continue with the new company as a vice-president. H. C. Raynes will be vice-president in charge of the Portsmouth plant.

Earnings of New York Plant.—The New York plant (Rock Plaster Corp.) in the year ended Dec. 31, 1925, showed net profits of $211,113, before depreciation charges, federal taxes and interest. After deducting $58,366 for depreciation, the remaining net profits were $152,747. For the 4 years ending Dec. 31, 1925, such average annual net profits were $180,701, and after deducting $51,348 for depreciation were $129,353. Additions and improvements recently completed have added 35% to the productive capacity of this plant. The New York plant alone is, therefore, earning considerably more than the annual interest charges on the present issue of bonds, so that the fixed charges of the company during the period required for equipping the Portsmouth plant should be more than provided for out of current earnings.

Sinking Fund.—A cumulative sinking fund, payable either in cash or in bonds of series A, will be payable annually, first payment March 1, 1931, equal to 3% of the total amount of series A bonds issued. This will be sufficient to retire at least 40% of series A bonds before maturity. The cash payments will be used to purchase series A bonds at the lowest prices obtainable, not exceeding the then calling price, or to call them if not so purchasable.

Cumberland Portland Cement Authorized to Sell $500,000 Stock

THE Cumberland Portland Cement Co., at Cowan, Tenn., has been licensed to sell $500,000 stock in Tennessee for a new cement plant at Cowan, according to announcement given out by R. E. McNellis of the Blue Sky division of the department of insurance and banking. The company filed a $100,000 surety bond to protect the investors. The company has already taken over several thousand acres of shale land near Cowan for the purpose of erecting the new plant, construction of which will begin in the near future.—*Nashville (Tenn.) Banner.*

Dividends Declared

Company	Rate	Payable
Arundel Corp	45c qu.	July 1
Arundel Corp. (extra)	15c	July 1
Atlas Portland Cement Co. (pfd.)	2% qu.	July 1
Bessemer Limestone and Cement Co. (com.)	1½% qu.	June 30
Bessemer Limestone and Cement Co. (pfd.)	1¾% qu.	June 30
Canada Cement Co. (pfd.)	1¾% qu.	Aug. 16
Charles Warner Co. (com.)	50c qu.	July 12
Charles Warner Co. (1st and 2nd pfd.)	1¾% qu.	July 22
Michigan Limestone and Chemical Co. (pfd.)	1¾% qu.	July 15

New Method for Burning Limestone

Continuous Process of Lime Burning Which Uses Small Sizes of Stone and Is Claimed to Have Twice the Efficiency of a Rotary Kiln

By R. W. Hyde

Engineer, Dwight and Lloyd Metallurgical Co., New York City

A METHOD and apparatus for burning limestone fines which differs radically from any at present in use has been developed by the Dwight and Lloyd Metallurgical Co. of New York. In this new process, calcination is accomplished by heat transferred to the stone from hot combustion gases which are drawn through a thin bed of the stone while it is being transported through the burning section of the apparatus on an endless conveyor system.

The apparatus is similar in some respects to the well known Dwight and Lloyd sintering machine that has been in commercial use in the smelting industry for the past 20 years and which is standard equipment at nearly all of the smelting plants in this country and abroad.

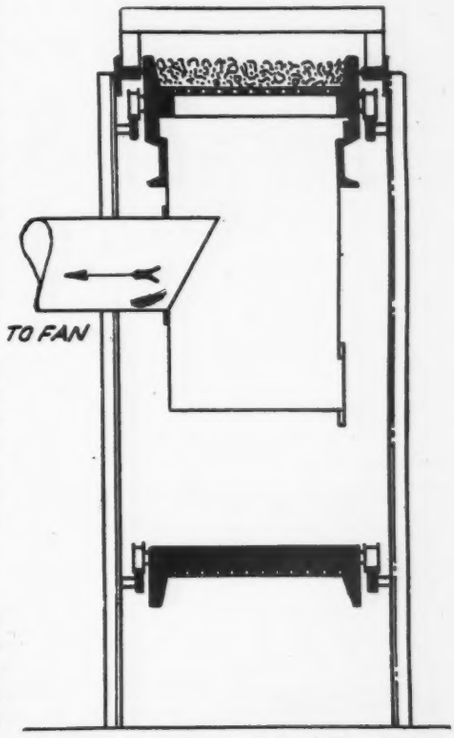
Some of the illustrations show the machine which has been developed for burning limestone, and one with which experiments were made. It consists of a structural steel framework supporting the track, suction box, refractory arch and driving mechanism. A series of small cars or pallets with grate bottoms are driven slowly around the track system by gearing. On the upper or operating track the pallets travel first under a hopper by which they are filled with the charge to be treated, then through the burning zone where they pass over a suction box which is connected to a fan for moving the gases, and under a low arch or roof.

Hot gases from the burning of any suitable fuel are passed from the combustion chambers into the space above the pallets beneath the roof and are drawn through the limestone by the fan, giving up their heat to the stone and calcining it as it passes through this burning zone. The speed of travel of the pallets, the volume and temperature of the gases and other factors are so co-ordinated that as the burning of the stone on a given pallet is completed, that pallet leaves the burning zone. It is only at the end of the burning zone where the bottom layer of stone is being burned that the gases drawn into the suction box are at all hot and this portion of the gases may be kept separate from the rest and used to preheat the stone.

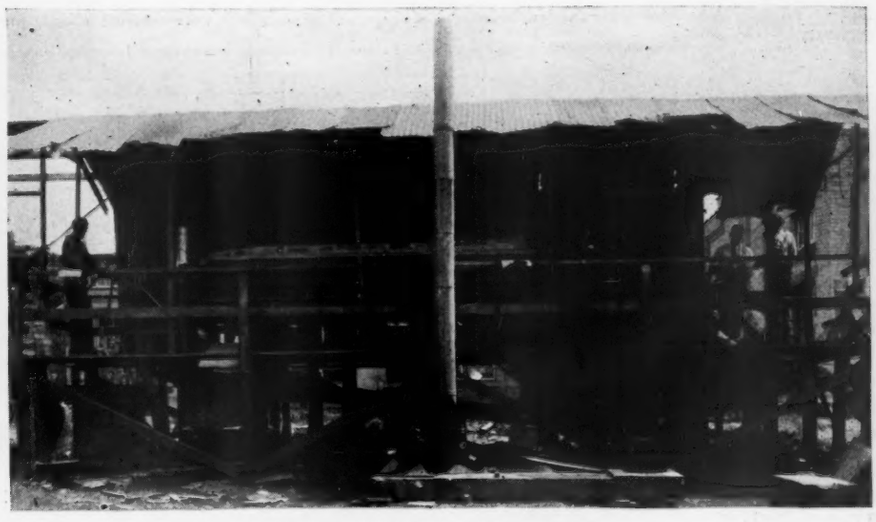
For a short distance beyond the burning zone the pallets continue under the roof to prevent cooling, but without having the hot gases drawn through the charge. The stone retains sufficient heat while passing through this section to burn completely through any of the larger particles which may not have been entirely burned before.

Pallets Protected with Burned Lime

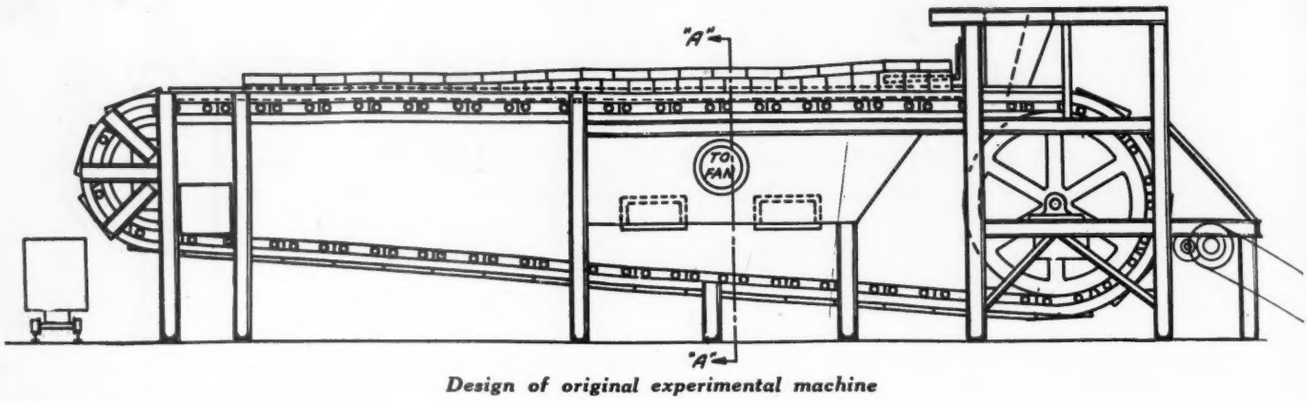
The framework and all moving parts of the machine are of steel or cast iron, with all parts that are exposed to a high heat protected. The roof is of refractory brick and insulated to prevent heat losses, while the grate bottoms of the pallets are protected by a layer of burnt lime placed on them before the stone is charged. In operation, heating is confined to the limestone itself and to the refractory roof and combustion chambers. None of the metal parts



Detail of connection of draft box to fan



End and side of experimental plant for burning lime before being enclosed



Design of original experimental machine

become unduly heated. That this construction is sound has been amply demonstrated in ore-sintering practice, where temperatures as high as 1300 deg. C. are reached in the bed of material undergoing treatment without damage to the pallets or other metal parts.

The operation is carried on in the following manner: The line of pallets is slowly pushed forward along the upper track by the driving mechanism. As each pallet passes under the double feed hopper a thin layer of burnt lime is fed directly on the grates and upon this the bed of limestone is placed. The loaded pallets then travel forward into the burning zone where hot gases, produced by burning gas, oil or any suitable fuel in combustion chambers alongside, are drawn through the stone.

The speed of the pallets, the gas volume and temperature and other factors are so regulated that the burning is practically complete by the time the pallets leave this section and enter the soaking zone beyond. In this forward section the roof is built close to the top of the bed, to prevent heat losses, so that the lime remains heated to burning temperature for a sufficient period to complete the burning of the larger particles. The time required for burning a 4-in. bed of stone varies from 20 to 40 min., depending on the size of the particles and the character of the stone, while the soaking period is about one-fourth of this. Leaving the soaking zone the pallets pass around the end of the machine, dumping the lime into cars or hoppers, and return upside down to the drive end of the machine.

Mixed Fuel and Stone Shortens Process

By mixing a small amount of fine coal or coke with the stone, it has been found that the time required for burning is shortened to an appreciable extent, with a saving in the total amount of fuel required. The amount of coal used is so small that practically no ash remains in the lime.

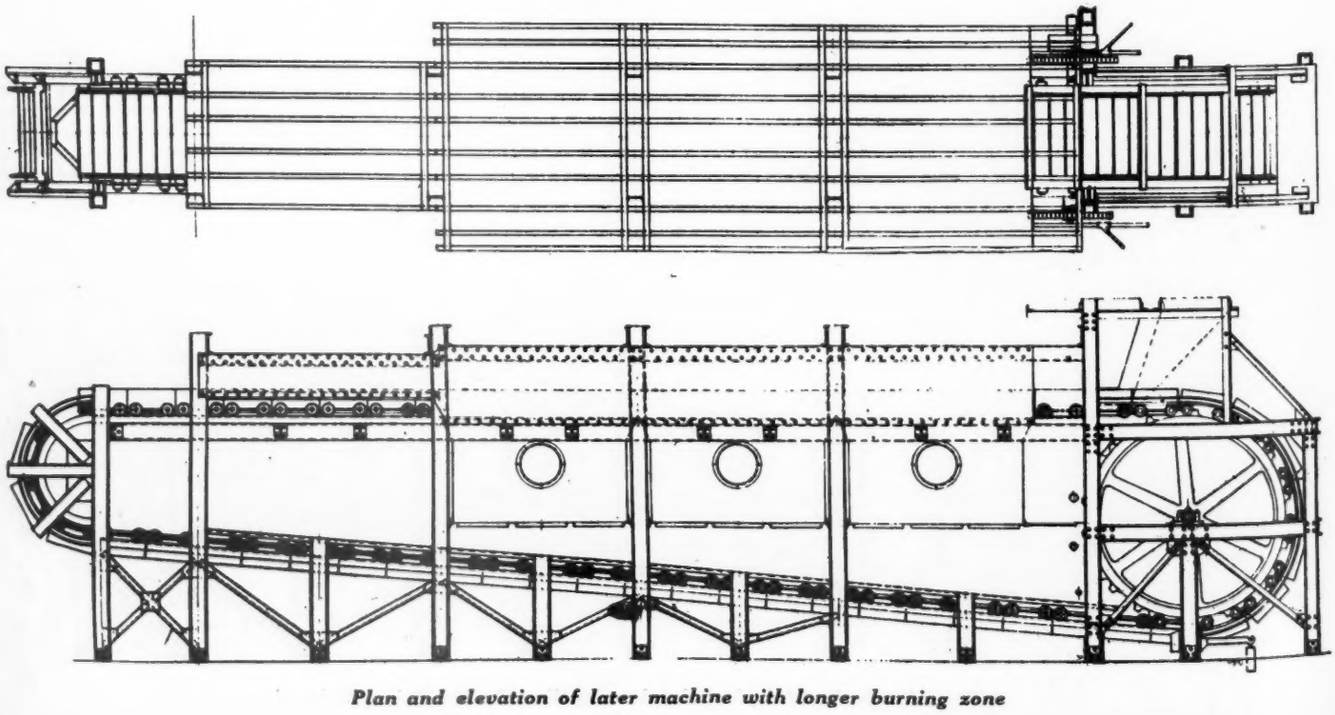
On a dense, high calcium limestone with which a large number of tests have been made, fuel ratios of 2.8 lb. of lime per pound of coal have been consistently obtained. The stone was crushed to pass a ⅜-in. screen and mixed with 5% of fine coal before burning on the machine. A softer dolomite treated in the same way but crushed only to 1-in. size was burned with a fuel ratio of 4.1 to 1. The fuel used in these tests was kerosene oil but the ratios given above are calculated on the basis of 12,000 B. t. u. coal. It is realized that kerosene is a very unsatisfactory fuel for burning lime as it produces a short, intensely hot flame and is prohibitive in cost, but it was the only fuel locally available for the work. Gas, fuel oil, coal or powdered coal can all be used, the choice depending on local conditions.

In the development work in which the above results were obtained, no attempt was made to insulate the apparatus against heat losses, which naturally were considerable. There is no doubt that the fuel ratios given above can be considerably improved by proper heat insulation, such as is provided for commercial apparatus.

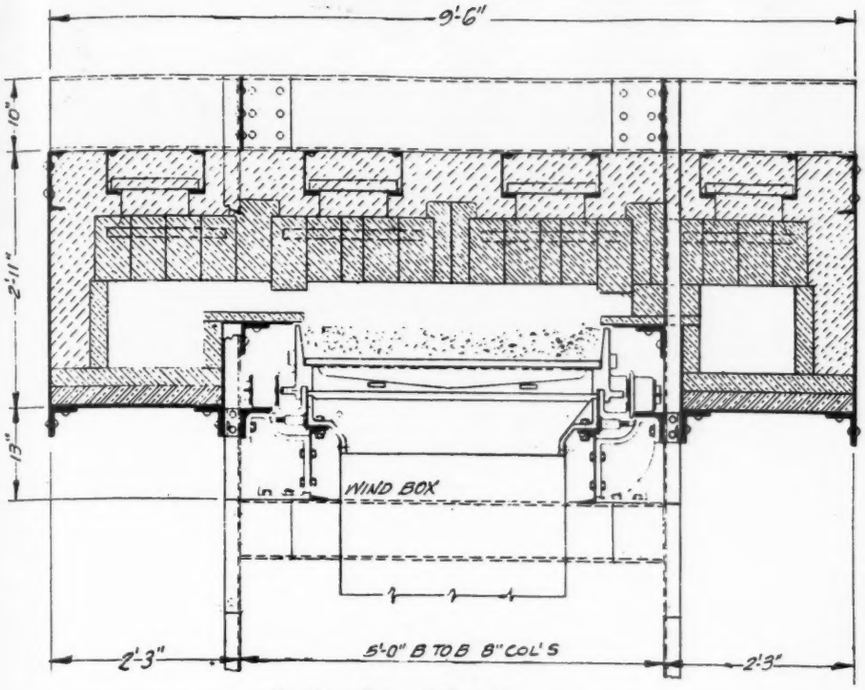
Standard Sizes of Machines

The photographs show the apparatus used in burning the limestone mentioned above. This little machine ran at the rate of seven to nine tons of lime per day.

The Dwight and Lloyd sintering machine,

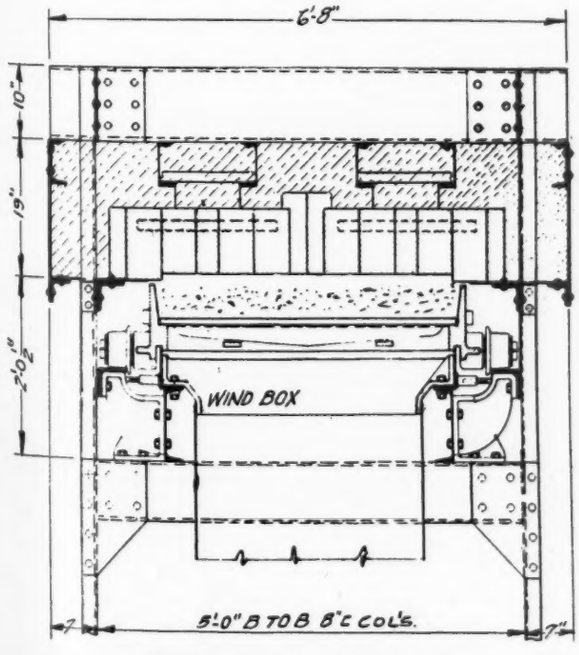


Plan and elevation of later machine with longer burning zone



Section through burning zone

the fan and the accessory apparatus for mixing and feeding the charge have all been thoroughly tried out by years of use in sintering ores. The machines are made in a number of sizes, from 24x120-in. active burning area to 42-in. by 66-ft., the overall sizes being from about 5x20 ft. to 7x85 ft. On lime burning, the capacities range from 7 tons of lime per 24 hr. to about 75 tons. The cost of the machine and accessory equipment varies from $6000 to $25,000, exclusive of buildings, bins, etc. On lime burning the capacity of a given size machine is less than on ore as the lime is much lighter than ore, so that it is impossible to get the same weight of lime as of ore on the pallets. Consequently the operating cost would probably be somewhat higher in burning lime than it is when sintering ore. From $1 to $2.50 per ton of lime would probably be a fair operating cost, this figure being based on the operation of over 200 Dwight and Lloyd machines in use in sintering ores, at costs varying from 50 cents to $1.50 per ton. The Dwight and Lloyd machine is primarily adapted for burning the finer sizes of stone, from ½-in. or ¾-in. down to powder. At most plants this size stone is a waste product, which the Dwight and Lloyd process provides a simple method for converting into a profit. The operation is simple and is automatic throughout. The apparatus for mixing and feeding the stone has been in use for years for sintering ores, and the machine itself is the result of many years' experience in sintering ores, coupled with a careful study of lime burning conditions.



Section through soaking zone

The United State Bureau of Mines, through the New Brunswick station, has been interested in the development of this process, and has co-operated with the Dwight and Lloyd Metallurgical Co. in many of the tests. The author desires particularly to express his appreciation of the advice and assistance given by Dr. Bowles and Mr. Myers of the New Brunswick station, whose report on this new process of lime burning will shortly be made public.

Burlington, Iowa, Has New Gravel Plant

BURLINGTON'S newest industry got under way recently when machinery was started and the first gravel was hauled out of the new pit of John W. Peters, just west of the Milwaukee road depot. Since early spring a large force of men has been actively engaged in grading, building sidetracks, bins, etc., and operations Wednesday were a climax to their efforts.

The new pit and equipment is one of the finest in the middle west and will have an output of from 500 to 600 yd. a day or 15 or 20 carloads. Mr. Peters already has orders booked that will keep the pit busy all summer.

Bins have been erected that have a capacity of 400 yd. A large crusher is located in the gravel hill. Material is sluiced into it and after being crushed goes onto a 135-ft. conveyor belt to the screens on the top of the bins. Here it is washed, under pressure, some 450 gal. of water per minute. At one side is a vibrating screen for mason sand.

The bins provide for truck loading and on one side is a sidetrack, the cars being loaded from the same bins. Nearly a quarter mile of sidetrack has been built to connect with the Milwaukee road.—*Burlington (Iowa) Democrat.*

Boston Imports Foreign Portland Cement

FOREIGN cement continues to arrive at Boston, Mass., in quantity, the British steamer *Overstone,* from Antwerp, in recently, bringing 119,000 bags or 5000 tons of Belgian cement and the Danish steamer *Emilie Mearsk,* from Aalborg, also arrived, had 79,650 bags of Danish cement. These consignments will be used largely in building construction in Boston and vicinity.—*Boston Herald.*

Southern Illinois Aggregate Men Form Traffic Association

PRODUCERS of sand, gravel and crushed stone of southern Illinois met in Cairo June 18 with Ray Williams, traffic manager of the Association of Commerce, with a view to effecting an organization so that they could take united action in securing uniform freight rates. An agreement, to be ratified by each concern represented, was reached.

Louisville, Nebraska, Quarries Sold for Cement Project?

THE Murphy, Patrick and National Stone Co. quarries at Louisville, Neb., have been sold to a Kansas City company which plans, it is understood, to erect a cement factory. Test holes showed an abundance of limestone and potter's clay. —*Omaha (Neb.) World-Herald.*

Traffic and Transportation

EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates on rock products up to the week beginning July 4:

CENTRAL FREIGHT ASSOCIATION DOCKET

13512. **Crushed stone** and screenings, carloads, Hillsville and Walford, Pa., to Argentine, Pa. Present rate, 13½c per Agent Jones' I. C. C. 1534; proposed, $1.05 per ton of 2000 lb.

13514. **Slag** (a product of iron and steel blast or open hearth furnaces), ashes and cinders (not including mill cinder and pyrites ore cinder), carloads, Massillon, O., to various destinations in Ohio.

W. & L. E. Stations—	*Rate
Orville, O.	40
Smithville, O.	50
Creston, O.	60
Lodi, O.	60
Spencer, O.	80
Wellington, O.	80
Brighton, O.	90
Clarksfield, O.	90
Hartland, O.	90
Norwalk, O.	90
South Lorain, O.	90
Cleveland, O.	90
Justus, O.	40
Beach City, O.	40
Dundee, O.	50
Barr, O.	50
Sugar Creek, O.	50
Baltic, O.	60
Chili, O.	60
Fresno, O.	80
Coshocton, O.	80
Conesville, O.	90
Dresden, O.	90
Ellis, O.	90
Zanesville, O.	100
Bolivar, O.	40
Zoar, O.	50
Valley Junction, O.	50
Somerdale, O.	50
New Cumberland, O.	50
Sherrodsville, O.	60
Leesville, O.	60
Bowerston, O.	60
Conotton, O.	60
Scio, O.	80
Jewett, O.	80
Rexford, O.	80
Adena, O.	90
Dillonvale, O.	90
Canton, O.	50
East Canton, O.	50
Robertsville, O.	60
Minerva, O.	60
Oneida, O.	60
Dell Roy, O.	80
A. C. & Y.-N. O. Stations—	
Risley, O. (via Spencer)	80
Litchfield, O. (via Spencer)	80
Thompsons, O.	90
Medina, O.	90
Boneta, O.	90
Sharon Center, O.	90
Paxton, O.	90
Copley, O. (Mogadore)	80
Barberton, O. (via Mogadore)	80
Fairlawn, O. (via Mogadore)	80
Akron, O. (via Mogadore)	80
Erie Railroad—	
Ravenna, O.	80
Tallmadge, O.	80
Akron, O.	80
Barberton, O.	80
Silver Creek, O.	80
Wadsworth, O.	80
Rittman, O.	60
Polk, O.	80
Burbank, O.	60
Sterling, O.	60
Mankin, O.	80
Ashland, O.	80
Milton, O.	90
Pavonia, O.	90
Summit, O.	90
Mansfield, O.	90

*In cents per ton of 2000 lb.

13516. **Crushed stone**, carloads, Ingalls, Ind., to Montclair, Ind. (via C. C. C. & St. L., Indianapolis, Ind., C. I. & W. R. R.). Proposed rate, 88c per net ton.

13518. **Cinder cement blocks**, carloads, Flint, Mich.

To—	Proposed rates
Port Huron, Mich.	176c
Howell, Mich.	164
Lansing, Mich.	164
Ionia, Mich.	176
Grand Rapids, Mich.	227
Durand, Mich.	139
Pontiac, Mich.	139
Ann Arbor, Mich.	176
Kalamazoo, Mich.	265
Battle Creek, Mich.	202
Jackson, Mich.	202

13523. **Crushed stone**, carloads, Lewisburg, O., to Penn. R. R. stations, viz.: Spring Valley, Roxanna and Waynesville, O. Present rate, 6th class; proposed, 90c per net ton.

13524. **Sand and gravel**, carloads, Merom, Riverton and Indianapolis, Ind., and Palestine, Ill., to Bloomington, Ind. Present rates, 93c per net ton; proposed, 85c per net ton.

13537. **Crushed stone**, in bulk, in open top cars, carloads, Perkins Spur, Ind., to Chase, Oxford and Templeton, Ind., to Otterbein, Ind. Present rates, 98c and 113c per ton, respectively, per Penn. R. R. I. C. C. F1532; proposed, 88c to Chase, Oxford and Templeton, Ind., and 101c per net ton to Otterbein, Ind.

13538. **Crushed stone**, carloads, France Quarries, O., to N. & W. Ry. stations, viz.: Batavia, Macon, Winchester, Seaman, Lawshe and Peebles, O. Present rate, to Batavia, O., 130c per ton, representing rate to Sardinia, O., applied under intermediate clause, authority C. C. C. & St. L. Ry. Tariff 1906A, 6th class to other points; proposed, 125c per net ton to Batavia, O., 145c per net ton to Macon, Winchester, Seaman, Lawshe and Peebles, O.

13540. **Dolomite** (raw or crude), and fluxing stone, carloads, Martin, O., to Lima, O., and to Lorain and South Lorain, O. Present rates, 161c to Lima, O., and 100c per gross ton to Lorain and South Lorain, O.; proposed, 126c to Lima, O., and 90c per gross ton to Lorain and South Lorain, O.

13541. **Rough or broken stone** (not dimension), carloads, Greencastle, Ind., to Holland, Mich. Present rate, 6th class rate of 22½c; proposed, 190c per net ton.

13545. **Sand and gravel**, carloads, from Indianapolis, Ind., to stations on the Penn. R. R. in Indiana, as shown in Exhibit "B," attached. Present rate, as per Exhibit "B," attached.

Exhibit "B"
(Sand and Gravel)

To—	From Indianapolis, Ind. Present rate	Proposed rate
Louisville Division stas.: Ind.:		
Greenwood	60	....
Whiteland	60	....
Franklin	69	65
Amity	69	65
Edinburg	85	70
Taylorsville	85	75
Columbus	88	75
Walesboro	88	80
Waynesville	88	80
Jonesville	88	85
Peters	....	85
Rockford	88	85
Seymour	88	85
Crothersville	95	90
Austin	95	90
Scottsburg	95	90
Vienna	110	95
Underwood	110	95
Henryville	110	95
Memphis	113	100
Speeds	113	100
Sellersburg	113	100
Jeffersonville	....	105
New Albany	....	105
Louisville, Ky.	....	118
Madison Branch stations: Ind.:		
Elizabethtown	88	80
Hege	....	80
Scipio	88	80
Queensville	88	80
North Vernon	100	85
Vernon	100	85
Grayford	100	85
Dupont	105	90
Middle Fork	105	90
Wirt	105	90
North Madison	110	95

To—	From Indianapolis, Ind. Present rate	Proposed rate
Louisville Division stas.: Ind.:		
Ben Davis	60	....
Herr	70	....
Lebanon	75	70
Pike	85	70
Reagan	82	70
Frankfort	82	70
Moran	88	80
Sedalia	88	80
Cutler	88	85
Bringhurst	95	85
Flora	95	85
Camden	95	90
Tecoma	101	90
Clymers	101	90
Long Cliff	101	95
Columbus Division Stations: Ind.:		
Cumberland	69	60
Gem	63	60
Philadelphia	70	60
Greenfield	70	65
Charlottsville	68	65
Knightstown	75	70
Dunreith	80	70
Lewisville	80	75
Starguhn	72	75
D. J. Tower	....	75
Dublin	72	80
Cambridge City	75	80
Germantown	95	80
Centerville	100	85
Richmond	100	85
St. Louis Division Stations:		
Ben Davis	60	....
Bridgeport	60	....
Plainfield	69	60
Cartersburg	70	60
Clayton	75	60
Ame	75	65
Coatesville	76	65
Fillmore	76	70
Greencastle	76	70
Limedale	76	70
Hamrick	76	....
Reelsville	76	....
Eagles	76	....
Harmony	76	....
Knightsville	76	....
Brazil	76	....
Turner	88	....
Staunton	88	....
Seelyville	88	....
Prairie	88	....
Terre Haute	101	88
Indianapolis Division Stations:		
Mars Hill Station	....	....
Valley Mills	60	....
Camby	69	60
Friendswood	69	60
Mooresville	70	60
Brooklyn	75	....

13571. **Whiting**, carloads, minimum weight 80,000 lb., Barberton, O., to Akron, O. Present rate, 7c per P. R. R. W. L. L. I. C. C. F900, in connection with C. F. A. T. B. Tariff 130P, I. C. C. 1594. Proposed rate, 5c.

13575. **Gypsum rock**, crushed (not ground). Grand Rapids and Alabaster, Mich., and Port Clinton and Gypsum, O., to points in the states of Michigan, Illinois, Missouri, Indiana, Ohio, Pennsylvania, Wisconsin, Kentucky. Present and proposed rates, as shown in Exhibit "A," attached.

Exhibit "A"

Statement of rates on gypsum rock from C.F.A. to cement mills in C.F.A.

To—	From—Port Clinton Pres.	Prop.	Gypsum Pres.	Prop.
Michigan:				
Lamson	$5.00	$3.10	$5.00	$3.10
Alpena	3.80	2.60	3.80	2.60
Newago	3.50	2.60	3.50	2.60
Bay City	3.10	2.15	3.10	2.15
Fenton	2.60	2.05	2.60	2.05
Port Huron	3.10	2.05	3.10	2.05
Bellevue	3.20	2.60	3.20	2.60
Union City	2.90	2.05	2.90	2.05
Coldwater	2.50	1.75	2.50	1.90
Quincy	2.50	1.75	2.50	1.75
Cement City	2.30	1.60	2.30	1.75
Four Mile Lake	2.50	1.90	2.50	1.90
Wyandotte	1.90	1.60	1.90	1.60
Detroit	1.90	1.60	1.90	1.75

To—	From—Port Clinton Pres.	Prop.	Gypsum Pres.	Prop.
Illinois:				
Dixon	4.0	2.60	4.40	2.60
La Salle	3.80	2.60	3.80	2.60
Oglesby	3.80	2.60	3.80	2.60
Utica	3.80	2.60	3.80	2.60
Missouri:				
St. Louis	4.10	3.10	4.10	3.10
Hannibal	4.10	3.10	4.10	3.10
Indiana:				
Jeffersonville	3.70	2.60	3.70	2.60
Buffington	3.20	2.60	3.20	2.60
Stroh	2.60	1.90	2.60	1.90
Mitchell	2.70	2.60	3.70	2.60
Speeds	3.80	2.60	3.80	2.60
Limedale	3.40	2.60	3.40	2.60
Ohio:				
Cincinnati	2.90	2.60	2.90	2.60
Toledo	1.60	1.20	1.60	1.20
Bay Bridge	.70	.70	.70	.70
Castalia	1.60	.90	1.60	.90
Middle Branch	2.30	1.75	2.30	1.75
Lisbon	2.80	2.05	2.80	2.05
Osborn	2.40	2.05	2.40	2.05
Fultonham	2.40	2.05	2.40	2.05
Superior	2.90	2.60	2.90	2.60
Ironton	2.90	2.60	2.90	2.60
Painesville	2.50	1.75	2.50	1.60
Pennsylvania:				
Bessemer	3.10	2.60	3.10	2.60
New Castle	2.50	2.05	2.50	2.05
Wampum	2.50	2.05	2.50	2.05
Universal	3.10	2.60	3.10	2.60
Walford	2.80	2.05	2.80	2.05
Wisconsin:				
Manitowoc	3.90	2.60	3.90	2.60
Kentucky:				
Louisville	3.70	2.90	3.70	2.90

To—	From—Grand Rapids Pres.	Prop.	Alabaster Pres.	Prop.
Michigan:				
Lamson	$2.50	$2.15	$3.10	$2.60
Alpena	2.80	2.60	1.01	1.01
Newago	1.30	1.20	2.60	2.60
Bay City	2.30	1.90	1.70	1.40
Fenton	2.10	1.75	2.30	1.90
Port Huron	2.40	2.15	2.40	2.05
Bellevue	1.90	1.40	2.50	2.15
Union City	1.90	1.60	2.60	2.60
Coldwater	2.10	1.75	2.70	2.60
Quincy	2.10	1.75	2.60	2.60
Cement	2.10	1.75	2.50	2.15
Four Mile Lake	2.10	1.75	2.60	2.60
Wyandotte	2.40	2.05	2.50	2.15
Detroit	2.40	2.05	2.50	2.15
Illinois:				
Dixon	2.52	2.52	4.20	3.10
LaSalle	2.52	2.52	3.70	3.10
Oglesby	2.52	2.52	3.70	3.10
Utica	2.52	2.52	3.70	3.10
Missouri:				
St. Louis	3.51	3.00	4.20	3.50
Hannibal	3.51	3.00	4.20	3.50
Indiana:				
Jeffersonville	3.20	2.60	3.90	3.10
Buffington	2.50	2.05	3.10	2.60
Stroh	2.10	1.75	2.80	2.60
Mitchell	3.20	2.60	3.90	3.10
Speeds	3.20	2.60	3.90	3.10
Limedale	2.80	2.60	3.50	3.10
Ohio:				
Cincinnati	3.50	2.60	3.90	2.80
Toledo	2.40	1.90	2.14	2.14
Bay Bridge	2.60	2.60	2.80	2.80
Castralia	2.60	2.60	2.80	2.80
Middlebranch	3.10	2.60	3.20	2.80
Lisbon	3.00	2.60	3.90	2.80
Osborn	2.90	2.60	3.20	2.80
Fultonham	3.20	2.60	3.61	3.10
Superior	3.40	2.80	3.60	3.10
Ironton	3.40	2.80	3.60	3.10
Painesville	3.90	2.60	3.90	2.80
Pennsylvania:				
Bessemer	4.10	2.80	4.30	3.00
New Castle	3.10	2.60	3.30	2.80
Wampum	3.10	2.60	3.30	2.80
Universal	4.10	2.80	4.30	3.00
Walford	3.90	2.60	3.90	2.80
Wisconsin:				
Manitowoc	2.60	2.15	3.20	2.60
Kentucky:				
Louisville	3.50	2.90	4.10	3.40

13581. **Crushed stone,** carloads, minimum weight as per Information Circular No. 3235, Middlepoint, Ohio, to Continental, Malinta and McClure, Ohio. Present rate, 80c; proposed, 90c per net ton.

13582. **Crushed stone,** carloads, minimum weight as per Information Circular No. 3235, Kokomo, Ind., to Center, Hemlock, Nevada and Windfall, Ind. Present rate, 69c per net ton; proposed, 68c per net ton.

13586. **Slag** (a product of iron and steel blast or open-hearth furnaces), ashes and cinders (not including mill cinder and pyrites ore cinders), carloads, Cleveland, Ohio, to Barberton, Ohio. Proposed, 80c per net ton.

13587. **Crushed stone,** carloads, minimum weight as per Information Circular No. 3235, Narlo, Ohio, to Deshler, Ohio. Present rate, $1 per net ton; proposed, 80c per ton.

13588. **Sand** (except blast, core, engine, filter, fire or furnace, foundry glass, grinding or polishing, loam, molding or silica) and gravel, carloads, minimum weight as per Information Circular 3235, Fairview, Penn., to Erie, Penn (N. Y. C. & St. L. delivery). Present rate, 60c per ton; proposed, 50c per ton.

13589. **Dolomite** (raw or crude), carloads, minimum weight as per Information Circular 3235, Woodville, Gibsonburg, Maple Grove and Bettsville, Ohio, to Ashland, Ky., and Jackson, Portsmouth and Ironton, Ohio. Present rates, $1.66 per gross ton; proposed, $1.56 per gross ton.

13596. **Sand,** viz.: Blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing loam, molding or silica, carloads, Cincinnati and Delhi, Ohio, to Madison, Ind. Present rate, 15c (6th class); proposed, $1.89 per net ton.

13608. **Dolomite,** raw or crude, and stone, fluxing, carloads, Martin, O., to Kentucky and Ohio points. Present and proposed rates:

To—	Prop.	Pres.
Ashland, Ky.	156	166
Bucyrus, O.	101	126
Columbus, O.	101	126
Hanging Rock, O.	156	202
Ironton, O.	156	166
Jackson, O.	156	166
Marion, O.	101	126
Pomeroy, O.	210	.....
Portsmouth, O.	156	166
South Columbus, O.	101	126
Wellston, O.	156	202

13579. **Sand** (other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) or gravel, carloads, Warsaw, Ind., to various points in Indiana. Present rates—No through rates in effect.

(Rates in cents per net ton.)

To—	Prop. rates	To—	Prop. rates
Indiana.		Indiana.	
Hammond	110	Monterey	85
Saxony	110	Leiters	85
Highlands	110	Pershing	80
Griffith	110	Rochester	80
Crown Point	110	Athens	75
Winfield	110	Disko	75
Palmer	110	Laketon	80
Hurlburt	105	Servia	80
Boone Grove	105	Bippus	85
Kouts	100	Huntington	90
Clanricarde	100	Markle	95
Wilders	100	Uniondale	95
Lomax	95	Kingsland	100
North Judson	95	Tocsin	100
Aldine	90	Magley	100
Bass Lake Jct.	90	Preble	100
Ora	90	Decatur	105

13580. **Sand and gravel,** carloads, minimum weight 90% of marked capacity of car.

Present and proposed rates to stations on the Kansas & Sidell R. R. and the Westfield R. R. as shown below:

To—	From Montezuma, Ind., C. I. & W. Pres.	Prop.	Macksville and Terre Haute, Ind., Pa. A. R. Pres.	Prop.
K. & S. R.R.				
Illinois.				
Hughes	76c	84c	88c	84c
Payne	76	84	88	84
Hume	*70	....	88	84
Brocton	76	84	84	....
Borton	76	84	*76	....
Warrington	76	84	84	....
Kansas	76	84	84	....
Westfield R. R.				
Kansas	84	....	76	84
Oilfield	84	....	76	84
Westfield	84	....	76	84
Briscoe	84	....	76	84
Casey	84	....	*76	....

To—	From—Terre Haute, Ind. C. C. C. & St. L. Present	Proposed	Cayuga, Ind. N. K. P. Present
K. & S. R. R.			
Hughes	88c	84c	84c
Payne	88	84	84
Hume	88	84	84
Brocton	84	....	*76
Borton	76	84	84
Warrington	76	84	84
Kansas	*76	....	84
Westfield R. R.			
Kansas	*76	....	84
Oilfield	76	84	84
Westfield	76	84	84
Briscoe	76	84	84
Casey	76	84	84

*Direct line rate.

TEXAS-LOUISIANA TARIFF BUREAU DOCKET

6645. **Lime,** in mixed carloads with cement plaster, between points in Texas. Proposition from shippers to amend Items 85 and 2040, Texas Lines Tariff 2-I, to provide that lime may be shipped in mixed carloads with cement plaster at the rate applicable to cement plaster, provided the weight of the lime contained in the car does not exceed 25% of the entire load. Shippers state that the lime they ship is in bags, and if proposed mixture is established will enable them to market considerable of this lime.

SOUTHWESTERN FREIGHT BUREAU DOCKET

8858. **Sand,** from Arkansas River, Okla., to Okmulgee, Okla. To establish a rate of 3½c per 100 lb. on sand, carloads, minimum weight as shown in Item 290 of S. W. L. Tariff No. 55-H. from Arkansas River, Okla., to Okmulgee, Okla.

Shipper contends that in order to place them in position to compete with producers at Tulsa, Ft. Gibson and Price they must have the same rate, and in view of the relative distance it is felt their request should be granted.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

10418. **Lime and limestone,** minimum weight 50,000 lb., from Cheshire, Farnams, North Adams, Renfrew, Richmond and Zylonite, Mass., to Weissport to Taylor, Penn., inclusive, 22½c, via B. & A. R. R., Selkirk Jct., N. Y., or Albany, N. Y. (or West Albany Tfr., N. Y., N. Y. C. R. R.), West Shore R. R., National Jct., N. J., Claremont, N. J. (or Weehawken, N. J., Float, Jersey City, N. J.), and C. R. R. of N. J., to destination. Reason—To place rate to Scranton rate points involved on parity with rate published to points taking Philadelphia rate basis.

10425. **Lime,** minimum weight 50,000 lb. from Cheshire, Farnams, North Adams, Renfrew and Zylonite, Mass., to various stations on Penn. R. R. taking Scranton rate basis 22½, Pittsburgh rate basis 23, and Cape May rate basis 25. Reason—To establish commodity rate to points involved comparable with rates to contiguous territory.

SOUTHERN FREIGHT ASSOCIATION DOCKET

27680. **Stone,** broken or crushed, from Mt. Vernon and Sparks Quarry, Ky., to Page, Wallins, Wilhoit and Baxter, Ky. It is proposed to revise the present rates on stone, broken or crushed, carload minimum 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern from and to the above-named points, to be relatively aligned with other competing points. The present and proposed rates are:

(In cents per net ton)

To—	From—Mt. Vernon, Ky. Pres.	Prop.	Sparks Quarry, Ky. Pres.	Prop.
Page, Ky.	120	104	120	99
Wallins, Ky.	130	113	130	108
Wilhoit, Ky.	130	113	130	113
Baxter, Ky.	140	117	130	113

27690. **Gravel** from Chattanooga, Tenn., to Jacksonville, Fla. In lieu of present rate of 212c per net ton it is proposed to establish the following rates on gravel, washed or unwashed, carload minimum weight 90% of marked capacity of car, except when cars are loaded to visible capacity actual weight will govern, from Chattanooga, Tenn., to Jacksonville, Fla., proper, 210c; for beyond, 194c per net ton, same as rates recently authorized for application from Knoxville, Tenn.

27693. **Crushed and/or ground gypsum,** carloads, from Saltville and Plasterco, Va., to Southeastern, Southwestern and Carolina territory. It is proposed to establish from Saltville and Plasterco, Va., to Southeastern, Southwestern and Carolina territory generally the same rates on crushed and/or ground gypsum, carloads, as are now applicable on wall plaster, carloads. That is to say, wherever the tariff carries wall plaster in the commodity description, then such description will be broadened to include crushed and/or ground gypsum.

27724. **Sand** from Wellington, Ala., to Rome and Dalton, Ga. In lieu of combination now applicable it is proposed to establish following rates on sand, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Wellington, Ala.: To Rome, 117c; to Dalton, 135c per net ton. Proposed rates are made on basis of the proposed Georgia joint line scale, less 10%, for short line distance via S.A.L., Jacksonville, Ala., and Southern Ry.

27725. **Limestone** from Ladds, Portland and Aragon, Ga., to Boyds and Newberry, S. C. It is proposed to establish reduced rate of 214c per net ton on limestone, ground, powdered or pulverized, carloads, minimum weight 60,000 lb., from and to points mentioned. The rate to Boyds is the same as the present rate from Mascot, Tenn., with rate to Newberry same as proposed to Boyds.

27746. **Ground or pulverized limestone** or marble from Sparta, Tenn., to Newberry and Prosperity, S. C.: Lowest combination is at present applicable. It is proposed to establish rate of 270c per ton 2000 pounds on ground or pulverized limestone or marble, carloads, minimum weight marked capacity of car, except when car is loaded to full visible capacity, actual weight will apply based on the proposed Georgia Scale extended for the distance.

27757. **Sand and gravel** from Kenneth, S. C., to Wagram, N. C. It is proposed to establish rate of 135c per ton 2000 lb. on sand and gravel, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Kenneth, S. C., to Wagram, N. C., made on basis of scale submitted to the Alabama and Georgia Public Service Commissions for joint line application over trunk and short lines, less 10%. Combination rates are at present applicable.

27763. **Sand** from Knoxville, Tenn., to Engle-

wood, Tenn. It is proposed to cancel rate of 102c per net ton published in Agent Glenn's Tariff I. C. C. A501 on sand, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, permitting rate of $1 per net ton to apply.

27786. **Stone,** broken from Blankenbakers and Louisville, Ky., to Cincinnati, O., and all stations in Kentucky on the L. & N. R. R. To a limited number of points commodity rates are in effect, generally class or combination rates are in effect. It is proposed to establish commodity rates on stone, broken, crushed, rubble and ballast, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight shall govern, from Blankenbakers and Louisville, Ky., to Cincinnati, O., and all stations in Kentucky on the L. & N. R. R.

27788. **Sand and gravel** from Jackson's Lake, Prattville, Junction, Coosada and Oktamulke, Ala., to Dublin, Ga., in lieu of lowest combination at present applicable it is proposed to establish rate of 176c per ton 2000 lb. on sand and gravel, carloads, minimum weight stenciled capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Jackson's Lake, Prattville Junction, Coosada and Oktamulke, Ala., to Dublin, Ga., made same as recently established from Montgomery, Ala., this basis being generally applicable from these points to Southeastern points.

27789. **Sand and gravel** from Berrylum, Ala., to Jacksonville, Fla. (proper), and (when far beyond). Lowest combination is at present applicable. It is proposed to establish rate from Berrylum, Ala., to Jacksonville, Fla. (proper), 203c, and to Jacksonville, Fla. (when for beyond), 206c per ton 2000 lb. on sand and gravel, in straight or mixed carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern. Proposed rate to Jacksonville (proper) made on basis of the proposed Georgia-Alabama Joint Line Scale, less 10%, rate to Jacksonville (when for beyond) made 3c higher than proposed rate to Jacksonville (proper).

27704. **Cement,** from Southeastern points and Ohio and Mississippi River crossing to N. C. & St. L. Ry., Centreville Branch stations. In order to place the rates on a more consistent basis it is proposed to revise the rates on cement, carloads, from Birmingham, Boyles and North Birmingham, Ala., Chattanooga, Tenn., Leeds, Ala., Richard City, Tenn., Rockmart, Ga., Spocari, Ala., St. Louis, Mo., Cairo, Ill., Paducah, Ky., Evansville, Ind., Louisville, Ky., Kosmosdale, Ky., and Cincinnati, O., to stations on the Centreville Branch of the N. C. & St. L. Ry. Present and proposed rates from and to a few representative points are as follows:

(Rates in cents per 100 lb.)

	From—			
	Birmingham, Ala.		Chattanooga, Tenn.	
To (Tenn.)—	Pres.	Prop.	Pres.	Prop.
Tidwell	*	18	20½	16
Lyle	*	18	22½	16
Graham	*	18	22½	16
Centreville	*	19	22½	16
Kimmins	*	19	22½	17
Hohenwald	*	19	22½	17
McLean	*	19	22½	17
Howard Switch	*	19	22½	17
North Riverside	*	19	22½	17
Allens Creek	*	19	22½	17
	Louisville, Ky.		Kosmsodale, Ky.	
Tidwell	23	17	23	20
Lyle	24	17	24	20
Graham	24	18	24	20
Centreville	25	18	25	21
Kimmins	27½	18	27½	21
Hohenwald	28	18	28	21
McLean	28½	19	28½	21
Howard Switch	28½	19	28½	21
North Riverside	28½	19	28½	21
Allens Creek	28½	19	28½	21

*No through rates in effect. Lowest combination applicable.

27813. **Stone** from Park Hill and Columbia, S. C., to West Palm Beach. Fla. It is proposed to establish through rates of $3 per ton 2000 lb. on stone, crushed stone or rubble or ietty, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Park Hill and Columbia, S. C., to West Palm Beach. Fla., in lieu of present rate of $3.15 per ton. Proposed rate is abritrarily made by use of proportional rate of $1.23 to Jacksonville plus proportion required by F. E. C. Ry. beyond.

27825. **Stone**, broken or crushed, from Russellville, Ky., to Dennis, Auburn, South Union, Petros, Rockfield, Memphis Junction and Bowling Green, Ky. It is proposed to establish commodity rates on stone, broken or crushed, carload, minimum weight 90% of the marked capacity of car, except when cars are loaded to their visible capacity, actual weight shall govern, from Russellville, Ky., to points shown, on basis of the proposed Georgia-Alabama single line scale, less 10% for the distances. Present and proposed rates are as follows:

To—	In cents per ton 2000 lb.	
Ky.:	Pres.	Prop.
Dennis	72	50
Auburn	81	54
South Union	81	54
Petros	81	59
Rockfield	90	63
Memphis Jct.	90	68
Bowling Green	90	68

To apply on intrastate traffic only.

27828. **Gravel,** from Iron City, Tenn., to Rockdale, Tenn. It is proposed to establish in lieu of present rate of 90c per ton 2000 lb., rate of 68c per ton 2000 lb. (intrastate traffic only) on gravel (for furnace use), carloads, minimum weight 90% of marked capacity of car, except where cars are loaded to their visible capacitl, actual weight shall govern from Iron City, Tenn., to Rockdale, Tenn. Proposed rate same as at present applicable on sand (for furnace use).

27870. **Slag** and stone from Longdale, Reussens, Eagle Mountain, Indian Rock and Rock Point, Va., to Morehead City and Beaufort, N. C. It is proposed to establish to Morehead City and Beaufort, N. C., a commodity rate of 230c per net ton on slag, carloads, minimum weight 100,000 lb., from Longdale and Reussens, Va., and on stone, crushed, carloads, minimum weight 100,000 lb., from Eagle Mountain, Indian Rock and Rocky Point, Va., in lieu of lowest combination at present applicable. Proposed rate is arbitrarily made with relation to existing rates to Elizabeth City, Edenton and Washington, N. C.

27880. **Slag** from Birmingham, Ala., and group points to Manchester, Ala. It is proposed to establish commodity rate of 95c per net ton on slag, carload, minimum weight 90% of marked capacity of car, except when cars are loaded to visible capacity, actual weight will govern, from Birmingham, Bessemer, Ensley, Pratt City and Woodward, Ala., to Manchester, Ala., in lieu of combination of 149 cents per ton 2000 lb. at present applicable. Proposed rate is same as in effect from Golden, Miss., and Spruce Pine, Ala., on gravel.

27935. **Sand and gravel** from and to points in Mississippi Valley territory. It is proposed to revise the minimum weight on sand and gravel, straight or mixed carloads, from and to Mississippi Valley points as shown in Agent Speiden's Tariff 131 Series I. C. C. 969, to be "90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will apply."

TRUNK LINE ASSOCIATION DOCKET

13518. (A) **Building lime,** carloads; (B) Agricultural, land, gas or glass lime, carloads; chemical lime, carloads; also ground limestone, carloads; minimum weight 30,000 lb. except ground limestone, minimum weight 50,000 lb.

To—Tacony, Pa.	Rates in cents per 100 lb.	
From—	(A)	(B)
York, Pa., to York Fair Grounds, Pa.	11½	11
Spring Grove, Pa., to Hanover, Pa.	12½	12
Union Bridge, Md., to Frederick, Md.	12½	12
Campbell, Pa., to Wrightsville, Pa.	11½	11
Codorus Mills, Pa.	11½	11
Myers Mill, Pa.	11½	11
Emigsville, Pa.	11½	11

Proposed rates subject to Rule 77.

Reason—Proposed rates are fairly comparable with others on like commodities from and to this same general territory. File 40820.

13521. **Ground limestone,** carloads, minimum weight 40,000 lb., from Carmine, Va., to New York, Long Island City, Elmira, N. Y., Newark and Trenton, N. J., 23c per 100 lb. Reason—To establish rates that are fairly comparable with others from and to this same general territory. File 40878.

13535. **Sand,** other than blast, engine, glass, moulding, foundry, silica, silex or quartz and gravel, carloads, minimum weight 90% of marked capacity of car, etc., from Silver Springs, N. Y., to Rochester, N. Y., 75c per 2000 lb. Reason—To place the shippers at Silver Springs on a comparable basis with competitors at other shipping points for approximately the same distance. File 40907.

3736. **Stone,** ground or pulverized (in bulk), crushed or rough, quarried, in straight or mixed carloads, from Krause, Ill., Signal Hill, Ill. Present rate, $1.70 per net ton; proposed, 73½c per net ton.

13494. **Marble chips,** dust and waste, carloads, minimum weight 50,000 lb., from Wingdale, N. Y., to 33rd St., 60th St. and 130th St., New York, N. Y., 10c per 100 lb., and to Brooklyn Stations, N. Y., 13½c per 100 lb. Reason—A new industry is in operation at Wingdale, N. Y., and it is desired to establish commodity rates on a basis comparable with present rates from Tuckahoe, N. Y. File 40446.

13495. **Limestone** and fluxing stone, carloads, minimum weight 90% of marked capacity of car, except when loaded to cubical or visible capacity, actual weight will apply, from Harrisville, N. Y., to Syracuse, N. Y., $1.26 per gross ton. Reason—Rates compares favorably with present rates on like traffic from Natural Bridge to Schenectady, N. Y. File 40669.

WESTERN TRUNK LINE DOCKET

2292-C. **Stone, crushed,** carloads, from Ely, Minn., to Chicago, Ill. Present rate, 15c per 100 lb.; proposed, 13½c per 100 lb. Minimum weight 90% of marked capacity of car and not less than 40,000 lb.

5217-B. **Stone,** crushed, carloads, from Mc. Dowell, Mo., to stations in Kansas and Nebraska on the Union Pacific and St. J. and G. I. R. R.s. Present—No joint through rates in effect. Proposed—To establish joint rates from McDowell, Mo., in proper relation to rates from Sugar Creek, Mo. Standard minimum weight basis. (By shipper.)

1303A. **Lime and plaster,** carloads, from Duluth, Minn., etc., to stations in Minnesota on the C. G. W. R. R. For example:

To—	Lime		Plaster	
	Pres.	Prop.	Pres.	Prop.
Rich Valley	14c	14c	14½c	14c
Rochester	17c	17c	21c	17½c
Red Wing	14c	14c	14½c	14c
Dundas	14c	14c	14½c	14c

3545N. **Sand and gravel,** straight or mixed, carloads, from Holliday, Kan., to Argentine, Kan. Present, 3c; proposed, 2½c. Minimum weight, 90% of marked capacity of car, except that when weight of shipment when loaded to full visible capacity of car is less than 90% of marked capacity of car, actual weight will apply. In no case shall the minimum weight be less than 40,000 pounds.

5540. **Sand, gravel and crushed stone,** carloads, from Winona, Minn., to Kansas City, Mo., St. Joseph, Mo., and stations taking same rates in W. T. L. Tariff 1Q. Present rate, 24c (Class E); proposed, 14½c. Minimum weight, marked capacity of car, except when car is loaded to full visible capacity the minimum weight will be the actual weight, but not less than 50,000 lbs. (By shipper.)

New Freight Schedules Suspended

THE Interstate Commerce Commission has suspended from June 26 until October 24 the operation of railroad tariff schedules which propose to restrict the application of rates between Missouri "B" territory and stations in Arkansas, Louisiana, Oklahoma and Texas so as to exclude all stations on the St. Louis-San Francisco Railway from St. Louis to Pacific, Mo., inclusive, which will have the effect of applying St. Louis territorial rates from and to the affected points.

Pacific, Mo., is the principal point affected and sand is the principal commodity moving.

The commission has also suspended from June 25 until October 23 the operation of railroad tariff schedules published by the Chicago, Burlington & Quincy Railroad, which propose to cancel the application of St. Paul, Minn., rates as applying to Fordson, Minn., on sand, gravel and crushed stone from certain stations in Minnesota and Wisconsin, which would result in the application of higher combination rates.

The rate per ton from Bay City, Wis., to Fordson, Minn., would be increased from 60 to 100 cents.

Proceedings on Lime Rates Discontinued

THE Interstate Commerce Commission has discontinued its proceeding of investigation of freight rates on lime between points in Central Freight Association and Western Trunk Line territories, stating that the railroads have withdrawn and cancelled the schedules which had been suspended by the commission and filed corrected schedules in lieu thereof satisfactory to the protestants.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Better Ways of Making Concrete Pipe

Efficient Methods Characterize Plant of George C. Bartram, Inc., at Buffalo, N. Y.

SEVERAL features of unusual interest are to be found in the recently completed concrete products plant of George C. Bartram, Inc., at Buffalo, N. Y. This plant is specializing in the manufacture of concrete pipe in the larger sizes, requiring reinforcement, and its owners have worked out some methods which are somewhat unusual and interesting in the extreme. These embody the experience of some of the men in this organization with other similar projects, as well as the result of a careful study of manufacturing methods in other plants throughout the country making a similar line of pipe.

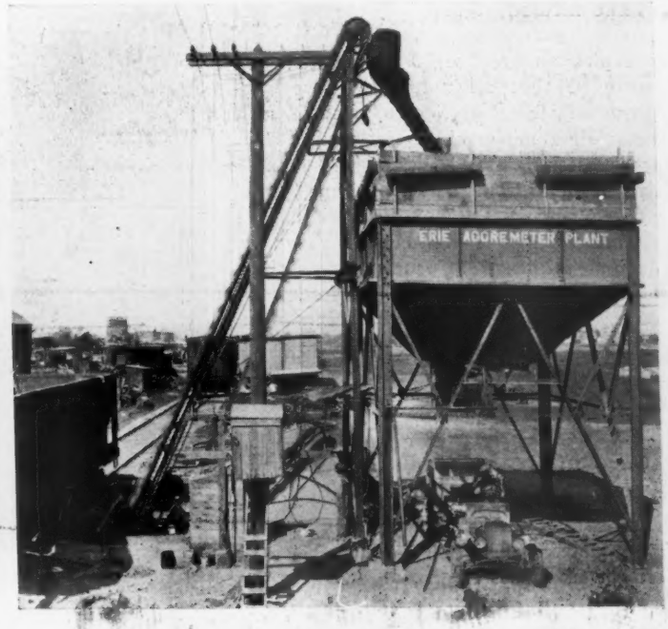
Reinforcing Joints Are Welded

One point of particular interest is that the reinforcing is fabricated with welded joints, the welding being done right at the plant. Mr. Bartram recognized the necessity for the best obtainable quality in a pipe which is to withstand the long and heavy duty of sewer and culvert pipe, and in the series of tests which he conducted he took particular note of the fact that rupture usually occurred at the point where the reinforcing was joined, in cases where the reinforcing web was merely overlapped and tied with wire. Greater strength at this point then became the problem to be solved, and on further experiment he found that by electrically welding all circumferential laps this difficulty was overcome, the welded type of reinforcing cage greatly increasing the strength of the finished pipe.

Pipe reinforcing electrically welded on the job

A portable field welding outfit is utilized for this purpose and all joints in the reinforcing are made in this way. The outfit is suspended by a chain from an overhead frame, holding it at any working level desired and giving it sufficient range of movement to accomplish its work without too much handling of

Metal containers dump cement into trucks at shed door



Aggregates go into trucks in measured quantities

Concrete pipe in several stages at pouring yard of George C. Bartram, Inc., Buffalo, N. Y.

the reinforcing cage. Current is supplied through a flexible but heavily insulated cable.

It will be noted from one of the illustrations that the joints are made with a long lap and that two longitudinal rods are used at this point.

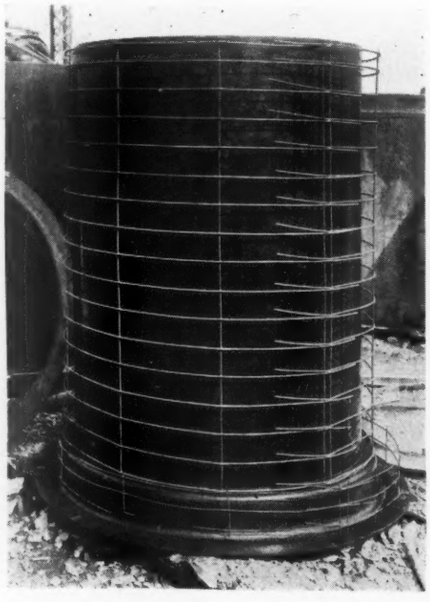
Little Lost Motion

The method of handling the materials is also somewhat unusual. This plant occupies an area of 10 acres and is so arranged that all materials move progressively from storage to finished product with a minimum of lost motion. The raw materials—sand, gravel and stone—are loaded from cars into an "Erie" aggremeter of 150 tons capacity. The aggremeter stands high enough above the ground to permit a truck being driven underneath and receive its measured load of aggregates. The aggremeter bin is filled by means of a belt-bucket elevator, working from a pit beneath the railroad track, which gets its materials from hopper bottom cars.

One-Ton Trucks Handle All Materals

All materials at this plant are handled with two Ford 1-ton trucks which move approximately 250 tons a day. That is, each truck makes 125 trips a day between material storage and mixing plant, keeping the mixer running continuously. A third Ford truck is used for general utility work and for loading pipe.

All lost motion and double handling of materials are eliminated. The first step in the day's production is for the Ford truck to stop at the cement house where cement is received sufficient for a batch. This cement is carefully measured and placed in large galvanized cans located in the doorway of the cement house. The cans mounted on a shaft are easily dumped. The truck then proceeds to the storage bin and is loaded with the aggregate. It is then driven to the mixing plant and the entire load dumped in the skip of the mixer.



Reinforcing joint has long lap and two longitudinal bars

Yard Arrangement Will Be Appreciated

The yard arrangement and the method employed for pouring the pipe are also most efficient and will appeal to other manufacturers in this line of business. The yard is laid out 600 ft. long and of a width to accommodate ten rows of pipe. At one side of the yard is a track of 10-ft. gauge carrying a truck on which is placed a mixer of the tilting drum batch type, an elevator tower with chute, and a hoist for handling the elevator bucket. The mixer is loaded from a skip which reaches to the ground and into which the trucks dump their loads of measured materials.

The chute from the hopper at the top of the tower has two swivel joints and is held in place and its movements partially controlled by a horizontal boom pivoted on the car. It thus becomes a most flexible unit and can cover a considerable section of the yard from one car position.

Steel Forms Are Used

Steel forms are used in making all the pipe, with hand latches for rapid closing and opening. After sufficient curing in the forms to be strong enough to roll, the pipe are taken out of the forms and transferred to the curing yard adjoining.

During cold weather pipe is made under cover. The moulds are set up beside a series of U-shaped platforms about 5 ft. high. Hand carts take concrete from the mixer at one end of the building and pour the forms from these platforms. All of the raw materials for the mixer are brought from the storage bins to the indoor plant in Ford trucks.

Utah Seeking Government Potash Experiment Station

THE mining committee of the Salt Lake City, Utah, Chamber of Commerce has asked Secretary of Agriculture William M. Jardine to support the establishment of a government experiment station in Utah for the purpose of devising methods for developing the Utah potash deposits in successful competition with the German and French Potash industries.

Steps have been taken to have the Utah Agricultural College conduct experiments for the use of the raw material for fertilizer. The experimental plant is desired so that this investigation may be carried out along with research on extraction processes.

More Data on Effect of Alkali on Concrete Pipe

THIS journal is indebted to J. M. MacAdam, secretary of the Western Concrete Pipe Co., Los Angeles, Calif., for a copy of a report recently made on the subject of the action of concrete exposed to alkali in Los Angeles and vicinity. The report was made by Salisbury, Bradshaw and Taylor, consulting engineers of that city, and includes detailed data on the examination of 40 concrete structures, principally sanitary and storm sewers, culverts and irrigation lines.

The engineers summarize their work as follows:

Finding concrete that has resisted alkali action in the extreme of the exposures we have in Southern California, proves that concrete can be made to resist this action. So we conclude that good concrete will resist alkali action that is found here and poor concrete will not. By good concrete is meant concrete that is made of good materials, properly graded, mixed, placed and cured; concrete that is dense, with sufficient cement content to insure a low permeability.

1. Concrete was found exposed to the most severe alkali conditions we have in this locality which has withstood the exposure without showing any sign of deterioration. Evidently, concrete can be made, without the use of extraneous substances, which will be immune to injury due to exposure to alkali in the locality. And, obviously, good concrete is safe to use in our alkali districts.

2. Concrete was found which has deteriorated, due to exposure to alkali. Rather than disproving paragraph (1), it indicates the quality of the concrete. And, obviously, it is not safe to use concrete of doubtful quality in our alkali districts.

3. The only apparent alkali action found was on the parts of concrete structures which were exposed to the air (i.e.), where evaporation of alkali solutions formed salt crystals that disrupted the concrete. This fact indicates that it is safe to use high quality concrete in our worst alkali if the concrete is covered with earth in such a way that not any of its surface is exposed to the air.

4. Concrete was found in dry alkali soil and showed no evidence of alkali action, regardless of the quality of the concrete. So, if the nature of the works did not require dense, strong concrete, leaner mixture could be specified for dry soil than should be required in wet alkali ground.

5. Sewer pipes and land drainage tile ordinarily have part of their interior surfaces exposed to evaporation to a limited extent, so that in using concrete for such works in alkali ground-water, the necessary requirement is that the concrete be first-class in quality. In order to insure uniformly high quality sewer or drain pipe, it is important that the pipe should be made to conform with rigid specifications equivalent to such a standard as those of the American Society for Testing Materials; and it is also important that recognized standard tests should be faithfully made.

It appears to us that the nature of the soils in the districts we have investigated is such that there is little cause for alarm in respect to the severity of alkali concentrations to which any works built of good concrete might be exposed. In damp ground, where capillary water would come to be exposed to evaporation on the concrete surfaces, the precaution necessary is to make concrete with a low permeability.

In any projects of land drainage or sewerage outside the city area there was observed no ground-water high enough in alkali concentration to affect tile or pipe made of good concrete. And in the city area there is but a small area of strong alkali ground-water. In this area we found concrete pipe free from injury; and it is our opinion that the use of well-made concrete pipe is justified.

The report is being published by the California Portland Cement Co., Los Angeles, Calif.

Evansville, Indiana, Insists on Good Cement Products

JOHN VOSS, city building commissioner of Evansville, Ind., has issued a warning that concrete block manufacturers who persist in turning out an inferior product would lose their municipal licenses. The ultimatum came as a result of complaints that some manufacturers were using not enough cement and too dry a mixture in making their products.

The warning, Mr. Voss said, was issued for the protection of the public. Copies of the letter were sent to all manufacturers of concrete blocks, although complaints had been lodged against only a few of them.

According to Mr. Voss, the engineering department of Evansville college is in a position to pass on mixtures used in the making of the blocks and to advise manufacturers whether or not they are abiding by rules and regulations of the building code.

South Jersey Cement Products Manufacturers Organize

THE South Jersey Concrete Products Manufacturers' Association, composed of the leading Camden and South Jersey concrete manufacturers, has been recently organized after a meeting of manufacturers held at Toppin Inn, Westville.

The concerns represented at the meeting were: E. P. Henry Co., Woodbury; Twentieth Century Block Co., Audubon; Lennox-Taylor Co., Camden; Wenonah Cement Products Co., Wenonah; F. R. Tilden, Haddonfield; Prince Concrete Co., Camden, and Robert G. Dawner.

Officers elected were: William N. Ward, president; Vernon P. Ward, first vice-president; George C. Kindle, second vice-president; Philip Prince, secretary, and James Henry, treasurer.

The association agreed on standards of quality which specified that products manufactured by members shall conform to the requirement of the Camden building code, or to the code of the municipality in which they operate. In no case shall the average compression test fall below 700 lb. on the gross area. It was agreed that tests be made of all the member's products, not less than four times a year.—*Camden (N. J.) Courier.*

Second Plant for Prince Concrete Company

A LARGE new plant has just been erected by the Prince Concrete Co. of Camden, N. J., to take care of its increased business. The new factory is located at Colonial avenue west of Haddonfield road, East Pensauken, and will begin operations as soon as necessary apparatus is installed.

The new plant will make the second factory in operation by the Prince company, the other factory being located in Hillcrest. Repairs and alterations have also been made to the main offices of the company.

The Prince company reports an increase of 23% over last year's business. More than 100 men are employed and kept busy all year round.

The company makes concrete blocks for every purpose. Blocks for building use, sidewalks, floors, foundations, driveways, roadbeds and many other uses are turned out in large quantities by the concern.

The concern prides itself upon the fact that in its twenty years of business not a single concrete block made by it has been rejected by Camden building inspectors or inspectors of any other city or town.

George C. Prince is president of the concern. His two sons, George R. and Philip H., are associated with him.—*Camden (N. J.) Courier.*

A $50,000 Sand and Gravel Plant Goes for $11,500

APPLETON SAND AND GRAVEL CO., Appleton, Wis., consisting of about 40 acres of land and a quantity of costly machinery, was sold to G. W. Ristow of Kaukauna, Wis., for $11,500 at a receivership sale recently in the circuit court at Appleton. George F. Fiedler, Seymour, who was appointed receiver of the gravel company last December, conducted the sale. A joint bid of $11,000 submitted by R. T. Jones, Seymour, and Antone Mankosky, Kaukauna, was the only other offer made for the plant. Appraisers had fixed the value of the property at about $46,000. Mr. Ristow has not stated what he intends to do with his newly acquired property. The money is to be paid to the receiver and the transfer of the property made within a month. Creditors of the gravel company will be paid in the order of their priority. C. G. Cannon is attorney for the receiver.

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	1.75	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	1.65	1.65	1.40	1.40	1.40
Cobleskill, N. Y.	1.50	1.35	1.25	1.25	1.25	.....
Dundas, Ont.	.53	1.05	1.05	.90	.90	.90
Frederick, Md.	.50@ .75	1.25@1.35	1.20@1.30	1.10@1.20	1.05@1.10	1.05@1.10
Munns, N. Y.	1.00	1.35	1.35	1.25	.....	.....
Northern New Jersey	1.60	1.50@1.80	1.30@2.00	1.40@1.60	1.40@1.60	.....
Prospect, N. Y.	1.00	1.50	1.40	1.30	1.30	.....
Walford, Penn.	.70	1.35	1.35	1.35	1.35	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Afton, Mich.	.....	.....	.50	.....	.....	1.50
Alton, Ill.	1.85	.....	1.85	.....	.....	.....
Bloomville, Middlepoint, Dunkirk, Bellevue, Waterville, No. Baltimore, Holland, Kenton, New Paris, Ohio; Monroe, Mich.; Huntington, Bluffton, Ind.	1.00	1.10	1.10	1.00	1.00	1.00
Buffalo and Linwood, Iowa	1.10	.....	1.10	.90	.95	.95
Chasco, Ill.	1.25	.....	.....	.....	.....	1.15
Columbia and Krause, Ill.	1.00@1.50	.90@1.10	1.20@1.35	1.00@1.20	.90@1.20	.....
			Flux 1.50@1.75			
Gary, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
Greencastle, Ind.	1.30	1.25	1.15	1.05	.95	.95
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
Milltown, Ind.	.....	90@1.10	.90@1.15	.90@1.00	.85@.90	.85@.90
Northern New Jersey	1.30	.....	1.80	1.60	1.40	.....
River Rouge, Mich.	1.10	1.10	1.10	1.10	1.10	1.10
St. Vincent de Paul, Que.	.80	1.25	.90	.85	.85	1.00
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	.....
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Toronto, Can. (k)	1.55	2.05	2.05	1.90	1.90	1.90
Stone City, Iowa	.75	.....	†1.10	1.05	1.00	.....
Waukesha, Wis.	.90	.90	.90	.90	.90	.90
SOUTHERN:						
Alderson, W. Va.	.60	1.45	1.35	1.25	1.20	1.15
Allgood, Ala.			Crusher run, fines out, for flux, 1.00 per net ton			
Cartersville, Ga.	1.00	1.50	1.50	1.15	1.15	.....
Chico, Texas	1.00	1.35	1.30	1.25	1.15	1.10
El Paso, Tex.	1.00	1.00	1.00	1.00	.....	.....
Ft. Springs, W. Va.	.50	1.60	1.50	1.35	1.25	.....
Graystone, Ala.			Crusher run fluxing stone. 1.00 per net ton			
Kendrick and Santos, Fla.			3½ in. and less, 1.00 per ton			
New Braunfels, Tex.	.30@1.00	1.00@1.30	1.00@1.30	.70@1.00	.70@ .90	.....
Olive Hill, Ky.	.50@1.00‡	1.00	1.00	1.00	1.00	1.00
Rocky Point, Va.	.50@1.00	1.40@1.60	1.30@1.40	1.15@1.35	1.10@1.20	1.00@1.05
WESTERN:						
Atchison, Kans.	.25	2.00	2.00	2.00	2.00	1.80
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.25	1.25	1.25	1.25	1.10	.....
Kansas City, Mo.	.75	1.50	1.50	1.50	1.50	1.50
Rock Hill, St. Louis Co., Mo.	1.30	1.30	1.35	1.35	1.35	1.30

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.80	1.70	1.45	1.20	1.05	.....
Duluth, Minn.	.90	2.25	1.90	1.50	1.35	1.35
Dwight, Calif.	1.00	1.00	1.00	.90	.90	.....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Texas	2.50	1.25	1.55	1.35	1.25	.....
New Haven, New Britain, Meriden & Wallingford, Conn.	.80	1.70	1.45	1.20	1.05	1.05
Northern New Jersey	1.50	2.00	1.80	1.40	1.40	.....
Oakland and El Cerritto, Cal.	1.00	1.00	1.00	.90	.90	.....
San Diego, Calif.	.....	2.75	2.55	2.35	2.35	.....
Sheboygan, Wis.	1.00	1.10	1.10	1.10	1.10	.....
Springfield, N. J.	1.60	2.00	2.00	1.70	1.60	.....
Toronto, Can. (k)	.....	3.58@4.40	3.05@3.45	.....	.....	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	.....
Coldwater, N. Y.—Dolomite			1.50 all sizes			
Columbia, S. C.—Granite	.50a	.....	1.75@2.00	1.75	1.60	.....
Eastern, Penn.—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Penn.—Quartzite	1 20	1 35	1.25	1.20	1.20	1.20
Lithonia, Ga.—Granite	.75	2.00	1.75b	1.35	.....	.....
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.—Granite	3.00@3.50	.....	2.00@2.25	2.00@2.25	.....	1.25@2.00
Northern New Jersey (Basalt)	1.50	2.00	1.80	1.40	1.40	.....
Richmond, Calif.—Quartzite	.75	.....	1.00	1.00	1.00	.....
Somerset, Pa. (sand-rock)	1.85@2.00a	.....	1.35@1.50	.....	1.00@1.50	.....
Toccoa, Ga.—Granite	.50	1.50	1.50	1.40	1.35	1.35

*Cubic yd. †1 in. and less. ‡Two grades. ||Rip rap per ton. (a) Sand. (b) to ¾ in. (c) 1 in., 1.40. (d) 2 in., 1.30. (e) Dust. (f) ¼ in. (h) less 10c discount. (i) 1 in., 1.40. (k) on cars, less 5c per ton discount.

Agricultural Limestone

(Pulverized)

Alderson, W. Va.—50% thru 50 mesh	1.50
Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 90% thru 100 mesh	6.00
Asheville, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk	2.75
Atlas, Ky.—90% thru 100 mesh	2.00
50% thru 100 mesh	1.00
Belfast and Rockland, Me. (rail), Lincolnville, Me. (water), analysis $CaCO_3$ 90.04%; $MgCO_3$ 1.5%, 100% thru 14 mesh, bags	4.50
Bulk	3.50
Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh	1.50
Branchton and Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	5.00
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; pulverized; 50% thru 50 mesh	1.50
Cartersville, Ga.—Pulverized, 2.25; 50% thru 50 mesh	1.50
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	2.50
Chico, Texas.—50% thru 50 mesh, bulk	1.75
Colton, Calif.—Analysis 90% $CaCO_3$, bulk	4.00
Cypress, Ill.—90% thru 100 mesh	1.35
Henderson, N. C. (paving dust)—80% thru 200 mesh, bags	4.25@ 4.75
Bulk	3.00@ 3.50
Analysis $CaCO_3$, 56%; $MgCO_3$, 42%; 65% thru 200 mesh, bags	3.95
Bulk	2.70
Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.00; bulk	2.50
Joliet, Ill.—85% thru 200 mesh	4.25
Knoxville, Tenn.—Analysis, 52% $CaCO_3$, 37% $MgCO_3$; 80% thru 100 mesh; bags, 3.75; bulk	2.50
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk	3.50
Marion, Va.—Analysis, 90% $CaCO_3$, pulverized, per ton	2.00
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 90% thru 100 mesh	3.90@ 4.50
Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35@ 1.60
Olive Hill, Ky.—50% thru 50 mesh, 2.00; 90% thru 4 mesh	1.00
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	2.50@ 2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Rocky Point, Va.—Analysis, $CaCO_3$, 95%; $MgCO_3$, 0.75%; 50% thru 100 mesh, burlap bags, 3.50; paper, 3.25; bulk	2.00
Toledo, Ohio, 30% through 50 mesh	2.25
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh, 2.10; 90% thru 50 mesh	1.65
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	2.50
West Stockbridge, Mass.—Analysis 90% $CaCO_3$, 50% thru 100 mesh; cloth bags, 4.75; paper, 4.25; bulk	3.25

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh	3.00
Atlas, Ky.—50% thru 4 mesh	.50
Bedford, Ind.—Analysis, 98.5% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 10 mesh	1.50
Brandon and Middlebury, Vt.—Pulverized, bags, 5.50; bulk	3.50

(Continued on next page)

Agricultural Limestone

Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh	1.75
50% thru 4 mesh	1.50
Chasco, Ill.—50% thru 100 mesh	1.20
Chicago, Ill.—50% thru 100 mesh; 90% thru 4 mesh	.80
Columbia, Krause, Valmeyer, Ill.—Analysis, 90% $CaCO_3$; 90% thru 4 mesh	1.35
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh	1.35
Dundas, Ont.—Analysis, 53.8% $CaCO_3$; $MgCO_3$, 43.3%. 50% thru 50 mesh; bags, $4.75; bulk	3.00
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh	1.50
Garnet, Okla.—All sizes	1.25
Kansas City, Mo.—50% thru 100 mesh	.75
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% through 10 mesh; 46% through 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk	1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh	1.85@ 2.35
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 25 to 45% thru 100 mesh	1.60
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Monroe, Mich. — Analysis, $CaCO_3$, 52.03%; 42.25% $MgCO_3$; 30% thru 100 mesh	2.30
Mountville, Va. — Analysis, 62.54% $CaCO_3$; $MgCO_3$, 35.94%, 100% thru 20 mesh; 50% thru 100 mesh bags	5.50
Pixley, Mo.—Analysis, 96% $CaCO_3$; 50% thru 50 mesh	1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh	1.65
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@ 1.40
Stone City, Iowa. — Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes	1.25

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk	3.00
Joliet, Ill.—85% thru 200 mesh	4.25
Piqua, Ohio, sacks, 4.50@5.00 bulk	3.00@ 3.50
Rocky Point, Va.—80% thru 200 mesh; bags, 4.25@4.75; bulk	3.00@ 3.50
Waukesha, Wis.—90% thru 100 mesh, bulk	4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Berkeley Springs, W.Va.—Glass sand	2.25
Buffalo, N. Y.	2.00@ 2.50
Cedarville and S. Vineland, N. J.—Damp	1.75
Dry	2.25
Cheshire, Mass.: 6.00 to 7.00 per ton; bbl	2.50
Columbus, Ohio	1.00@ 1.25
Estill Springs and Sewanee, Tenn	1.50
Franklin, Penn.	2.00
Gray Summit and Klondike, Mo.	2.00
Los Angeles, Calif.—Washed	5.00
Mapleton Depot, Penn.	2.00@ 2.25
Massillon, Ohio	3.00
Mineral Ridge and Ohlton, Ohio	2.50
Oceanside, Calif.	3.00
Ottawa, Ill.	.75@ 1.25
Pittsburgh, Penn.—Dry	4.00
Damp	3.00
Red Wing, Minn.: Bank run	1.50
Ridgway, Penn.	2.50
Rockwood, Mich.	2.75@ 3.25
Round Top, Md.	2.25
San Francisco, Calif.	4.00@ 5.00
St. Louis, Mo.	2.00
Sewanee, Tenn.	1.50
Thayers, Penn.	2.50
Utica, Ill.	1.00@ 1.25
Zanesville, Ohio	2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.50@ 1.75
Columbus, Ohio		.30@ .80
Eau Claire, Wis.	4.25	.60@ 1.25
Estill Springs and Sewanee, Tenn.	1.35@ 1.50	1.35@ 1.50

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Attica and Franklinville, N. Y.	.75@ .85	.75	.85	.75	.75	.75
Boston, Mass.‡	1.40	1.40	2.25		2.25	2.25
Buffalo, N. Y.	1.10	.95			.85	
Erie, Pa.		1.00*		1.50*	1.75*	
Farmingdale, N. J.	.58	.48	.75	1.20	1.10	
Hartford, Conn.	.65*					
Leeds Junction, Me.		.50	1.75		1.35	1.25
Machias Jct., N. Y.		.75	.75		.75	
Montoursville, Penn.	1.00	1.00	1.00	.75	.75	.75
Northern New Jersey	.40@ .50		1.25		1.25	
Olean, N. Y.		.75	.75		.75	
Shining Point, Penn.			1.00	1.00	1.00	1.00
Somerset, Pa.		1.85			1.50	
South Heights, Penn.	1.25	1.25	.85	.85	.85	.85
Washington, D. C.	.85	.85	1.70	1.50	1.30	1.30
CENTRAL:						
Algonquin and Beloit, Wis.	.50	.40	.60	.60	.60	.60
Appleton and Mankato, Minn.		.45	1.25	1.25	1.25	1.25
Attica, Ind.			All sizes .75@.85			
Aurora, Oregon, Sheridan, Moronts, Yorkville, Ill.	.40@ .50	.40@ .60	.20@ .50	.50@ .60	.60	.55@ .60
Barton, Wis.		.50		.70	.70	.70
Chicago, Ill.	.70	.60	.50	.60	.60	.60
Columbus, Ohio		.70	.70	.70	.70	
Des Moines, Iowa	.40	.40	1.50	1.50	1.50	1.50
Eau Claire, Wisc.	.60@1.25	.45	.85@1.25		.95	
Elgin, Ill.		.20*	.50*	1.50*	1.50*	1.50*
Elkhart Lake, Wis.	.40	.40	.50	.50	.40	.40
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Ft. Dodge, Iowa	.85	.85	2.05	2.05	2.05	2.05
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Grand Haven, Mich.		.60@ .80		.60@1.00		.60@1.00
Grand Rapids, Mich.		.50		.80	.80	.70
Hamilton, Ohio		1.00			1.00	
Hersey, Mich.		.50				.70
Humboldt, Iowa	.50	.50	1.50	1.50	1.50	1.50
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Jedbury and St. Louis, Mo.	.75	.90	1.00	.90	.90	.90
Joliet, Plainfield and Hammond, Ill.	.60	.50	.50	.60	.60	.60
Mason City, Iowa	.50	.50	1.45	1.45	1.45	1.35
Mattoon, Ill.	.75	.75	.75	.75	.75	.75
Milwaukee, Wis.		1.01	1.21	1.21	1.21	1.21
Moline, Ill.	.60@ .85	.60@ .85	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Northern New Jersey	.70	.70			1.60	
Oregon City, Ore.		1.25	1.25	1.25	1.25	1.25
Palestine, Ill.	.75	.75	.75	.75	.75	.75
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
Terre Haute, Ind.	.75	.60	.90	.75	.75	.75
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.25	1.10	1.10
Zanesville, Ohio		.60	.50	.60	.80	
SOUTHERN:						
Charleston, W. Va.			All sand, 1.40.	All gravel, 1.50.		
Chattanooga, Tenn.		1.65			1.45	
Chattahoochie River, Fla.		.70		1.75		
Eustis, Fla.	.60@ .70					
Knoxville, Tenn.	1.00	1.00	1.20	1.20	1.20	1.20
Lindsay, Texas					.55	
Macon, Ga.	.50	.50				
New Martinsville, W. Va.	1.00	.90@1.00		1.20@1.30		.80@ .90
Roseland, La.	.50	.40	2.25	1.25	1.00	
WESTERN:						
Kansas City, Mo.	1.00	.70				
Los Angeles, Calif. (points all around) (d)	.60	.50	.85	.85	.85	.85
Los Angeles district (bunkers) †	1.50	1.40	1.85	1.85	1.85	1.85
Phoenix, Ariz.	1.25*	1.00*	2.50*	2.00*	1.75*	1.50*
Pueblo, Colo.	.80	.65		1.35		1.20
San Diego, Calif.	.65@ .75	.65@ .75	1.50	1.30	1.10	1.10
Seattle, Wash. (bunkers)	1.50*	1.50*	1.50*	1.50*	1.50*	1.50*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			Dust to 3 in., .40			
Chicago, Ill.						.40
Dudley, Ky.	1.10	1.00	.90			
East Hartford, Conn.			Sand, .75*			
Ferrysburg, Mich.						.65@1.00
Gainesville, Texas		.95				.55
Grand Haven, Mich.						.80
Grand Rapids, Mich.				.60		
Hamilton, Ohio					.70	
Hersey, Mich.				.55		
Indianapolis, Ind.			Mixed gravel for concrete work, at .65			
Joliet, Plainfield and Hammond, Ill.	.35	1.25				
Lindsay, Texas						.55
Macon, Ga.	.35	.35				
Mankato, Minn.			Pit run sand, .70			
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Ottawa, Oregon, Moronts and Yorkville, Ill.			Ave. .60 per ton all sizes			
Roseland, La.						.60
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Shining Point, Penn.			Concrete sand, 1.10 ton			
Smithville, Texas	.50	.50	.50	.50	.50	.54
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Waukesha, Wis.	.60	.60	.60	.60	.60	.64
Winona, Minn.	.60	.60	.60	.60	.60	.60
York, Penn.	1.00	1.10				

(a) ¼ in. down. (b) River run. (c) 2½ in. and less.
*Cubic yd. †Include freight and bunkerage charges and truck haul. ‡Delivered on job.
(d) Less 10c per ton if paid E.O.M. 10 days. (e) pit run. (f) plus 15c winter loading charge.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.				.30@ .35			
Albany, N. Y.	2.25	2.00	2.25			4.00	
Arenzville, Ill.	1.50@1.75			1.00			
Beach City, Ohio	2.00@2.25	2.00		1.75	2.00@2.50		1.75
Buffalo, N. Y.	1.50	1.50		2.00@2.50			
Columbus, Ohio	1.50@2.00	1.25@1.75	2.00@2.50	.30@1.00	2.00@2.50	3.50@4.00	1.25@1.50
Eau Claire, Wis.						3.00	
Elco, Ill.	Ground silica per ton in carloads—18.00@31.00						
Elnora, N. Y.			1.75				
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35@1.50	
Franklin, Penn.	1.75	1.75		1.75			
Kasota, Minn.							1.10a
Klondike, Mo.	1.75		2.00	1.75	1.75		1.25
Mapleton Depot, Penn.	2.25	2.00		2.00	2.00	2.25	
Massillon, Ohio	2.50	2.50		2.50	2.50		
Michigan City, Ind.				.30@ .35			
Montoursville, P'n.				1.25@1.35			
New Leyington, O.	2.00	1.50					
Ohlton, Ohio	1.75*	1.75*	2.00*	2.00*	1.50*	2.50*	1.75*
Ottawa, Ill.		.75@1.00†					
Red Wing, Minn.	1.25		1.25	1.50	1.50	3.50	1.50
Ridgeway, Penn.	1.50	1.50					
Round Top, Md.	1.50	1.50		1.60		2.25	
San Francisco, Calif.	3.50	4.75	3.50	3.50@5.00	3.50@4.50	3.50@5.00	
Tamalco, Ill.		1.40@1.60					
Tamms, Ill.	Ground silica per ton in carloads—20.00@31.00						
Thavers, Penn.	1.25	1.25		2.00			
Utica, Ill.¶		.50@.85	.50@.90	.60@.75	.60@.90		
Utica, Ill.	1.00@1.25		1.00@1.25	1.00@1.25	1.00	3.00@3.25	1.00@3.25
Utica, Penn.	1.75	1.75		2.00			
Warwick, Ohio	1.75*@2.25	1.75*		1.75*@2.25			
Zanesville, Ohio	2.00	1.50	2.00	2.00	2.00		

*Green. †Crude silica, crushed and screened, not washed or dried. ‡Plus 75c per ton for winter loading. ¶Crude. §Crude and dry. (a) delivered.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Emporium nd Dubois, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern, N. J.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
Reading, Pa.	2.50	1.00		1.25			
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.45*	1.80*	1.45*	1.45*	1.45*	1.45*
Jackson, Ohio		1.05*		1.30*	1.00	1.30*	1.30*
Toledo, Ohio	1.50	1.35	1.35	1.35	1.35	1.35	1.35
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.		1.55*		1.55*	1.55*	1.55*	1.55*
Ensley and Alabama City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruessens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.	2.05*	.80*	1.35*	1.25*	.90*	.90*	

*5c per ton discount on terms.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.			12.00					2.15e
Buffalo, N. Y.		12.00	12.00	12.00			10.00	1.95d
Chazy, N. Y.	12.50	10.50	8.00	12.00	11.50	16.50	10.00	2.50₂
Lime Ridge, Penn.							5.00a	
West Stockbridge, Mass.	12.00	10.00	5.60					2.00t
Williamsport, Penn.			10.00				6.00	
York, Penn.		9.50	9.50	10.50	8.50	10.50	8.50	1.65i
CENTRAL:								
Carey, Ohio	12.50	8.50	8.00		9.00		8.50	1.50
Cold Springs, Ohio	12.50	8.50	8.50		9.00		8.00	
Delaware, Ohio	12.50	10.00	9.00	10.00			9.00	1.50
Frederick, Md.		9.50	9.50	9.50	8.00	9.50	7.50	1.45e
Gibsonburg, Ohio	12.50	8.50	8.50		9.00	11.00	8.50	
Huntington, Ind.	12.50	8.50	8.50		9.00		8.00	
Luckey, Ohio (f)	12.50	8.50	8.50					1.50₆
Marblehead, Ohio		8.50	8.50		9.00		8.00	1.50w
Marion, Ohio		8.50	.850				8.00	1.70d
Milltown, Ind.		9.00@10.00		10.00p			8.50q	1.40r
Sheboygan, Wis.	11.50				9.50		9.50	.95
Tiffin, Ohio					9.00			
White Rock, Ohio	12.50				9.00	11.00	8.00	
Wisconsin points (f)		11.50					9.50	
Woodville, Ohio	12.50	8.50	8.00	13.50	9.00	11.00₁	9.00	1.50c
SOUTHERN:								
Allgood, Ala.	12.50	10.00			8.50		8.50	1.50
El Paso, Tex.							8.00	
Graystone, Ala.	12.50	10.00		12.50			8.50	1.50
Keystone, Ala.	12.50	10.00	10.00	10.00			8.50	1.50u
Knoxville, Tenn.	20.25	10.00	10.00	10.00			8.50	1.50
Ocala Fla.		13.50	10.00				12.50	1.70
WESTERN:								
Calcite, Colo.							9.25	
Kirtland, N. M.							15.00	
Limestone, Wash.	15.00	15.00	10.00	15.00	16.50	16.50	16.50	2.09
Dittlinger, Tex.		12.00@13.00					9.50p	1.50₄
San Francisco, Calif.	19.50@21.00	18.00@20.00	15.00	18.50			14.00s	2.00
Tehachapi, Calif.			8.00				13.00z	2.20x
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

†50-lb. paper bags; (a) run of kilns; (c) wooden, steel 1.70; (d) steel; (e) per 180-lb. barrel; (f) dealers' prices, net 30 days less 25c disc. per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days; (i) 180-lb. net barrel, 1.65; 280-lb. net barrel, 2.65; (p) to 11.00; (q) to 8.75; (r) to 1.50; (s) in 80-lb. burlap sacks; (t) to 3.00; (u) two 90-lb. bags; (v) oil burnt; wood burnt 2.25@2.50; (x) wood, steel 2.30; (z) to 15.00; (*) quoted f.o.b. New York; (‡) paper bags; (w) to 1.50 in two 90-lb. bags, wood bbl. 1.60; (¶) to 10.00; (1) 80-lb. paper bags; (2) to 3.00; (3) to 9.00; (4) to 1.60. (5) to 16.00; (6) wood bbl., steel, 1.80.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing sand	Traction
Gray Summit and Klondike, Mo.		1.75
Mapleton Depot, Penn.	2.00	2.00
Massillon, Ohio		2.25
Mineral Ridge and Ohlton, Ohio	*1.75	*1.75
Montoursville, Penn.		1.25
Ottawa, Ill.	1.00@ 1.50	
Red Wing, Minn.		1.25
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50@ 4.50	3.50@ 4.50
Thayers, Penn.		2.25
Utica, Ill.	1.00@ 3.00	1.00
Warwick, Ohio		2.25
Zanesville, Ohio		2.50

*Wet.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Baltimore, Md.:	
Crude talc (mine run)	3.00@ 4.00
Ground talc (20-50 mesh), bags	10.00
Cubes	55.00
Blanks (per lb.)	.08
Pencils and steel worker's crayons, per gross	.08 1.25
Chatsworth, Ga.:	
Crude Talc	5.00
Ground (150-200 mesh), bulk	10.00
Pencils and steel worker's crayons, per gross	1.00@ 2.00
Chester, Vt.:	
Ground talc (150-200 mesh), bulk	8.50@10.00
Including bags	9.50@11.00
Chicago and Joliet, Ill.:	
Ground (150-200 mesh), bags	30.00
Dalton, Ga.:	
Crude talc	5.00
Ground talc (150-200) bags	10.00@12.00
Pencils and steel workers' crayons, per gross	1.00@ 1.50
Emeryville, N. Y.:	
(Double air floated) including bags;	
325 mesh	14.75
200 mesh	13.75
Hailesboro, N. Y.:	
Ground white talc (double and triple air floated) including bags, 300-350 mesh	15.50@20.00
Henry, Va.:	
Crude (mine run)	3.50@ 4.50
Ground talc (150-200 mesh), bulk	8.75@16.00
Joliet, Ill.:	
Roofing talc, bags	10.00
Ground talc (200 mesh), bags	30.00
Keeler, Calif.:	
Ground (200-300 mesh), bags	20.00@30.00
Natural Bridge, N. Y.:	
Ground talc (300 mesh), bags	13.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 5.00
Mt. Pleasant, Tenn.—B.P.L. 72%	5.00@ 6.00
Tennessee—F.O.B. mines, gross ton, unground brown rock, B.P.L. 72%	5.00
B.P.L. 75%	6.00
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	7.25@ 8.25

Ground Rock

(2000 lbs.)

Centerville, Tenn.—B.P.L. 65%	7.00
Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 4.50
Mt. Pleasant, Tenn.—B.P.L. 65%	7.25@ 9.25
Twomey, Tenn.—B.P.L. 65%	8.00@ 9.00

Florida Phosphate

(Raw Land Pebble)

(Per Ton.)

Florida—F. O. B. mines, gross ton,	
68/66% B.P.L., Basis 68%	3.25
70% min. B.P.L., Basis 70%	3.75
72% min. B.P.L., Basis 72%	4.25
75/74% B.P.L., Basis 75%	5.25
77/76% B.P.L., Basis 77%	6.25

Mica

Prices given are net, F.O.B. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton	125.00@150.00
Punch mica, per lb.	.06
Scrap, per ton, carloads	20.00
Rumney Depot, N. H. — per ton,	
mine run	360.00
Mine scrap	24.00
Clean shop scrap	27.00
Dry ground, 20 mesh	28.00
40 mesh	35.00
60 mesh	40.00
100 mesh	60.00
200 mesh	80.00
Roofing mica	27.00
Punch mica, per lb.	.10

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars	.....	10.50
Brandon, Vt.—English pink and English cream	*11.00	*11.00
Brandon grey	*11.00	*11.00
Brighton, Tenn.—Pink	.....	†6.00
Buckingham, Que.—Buff stucco dash	.....	‡12.00@14.00
Chicago, Ill. — Stucco chips, in sacks f.o.b. quarries	.....	17.50
Crown Point, N. Y.—Mica Spar	.....	8.00@10.00
Easton, Penn., and Phillipsburg, N. J.	10.00@16.00	10.00@16.00
Haddam, Conn. — Felstone buff	15.00	15.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio — Concrete facings and stucco dash	.....	6.00@16.00
Middlebrook, Mo.—Red	.....	20.00@25.00
Middlebury and Brandon, Vt.—Middlebury white	.....	‡9.00
Milwaukee, Wis.	.....	14.00@34.00
Newark, N. J.—Roofing granules	.....	7.50
New York, N. Y.—Red and yellow Verona	.....	32.00
Red Granite, Wis.	.....	7.50
Sioux Falls, S. D.	7.50	7.50
Stockton, Calif. — "Natrock" roofing grits	.....	15.00@20.00
Tuckahoe, N. Y.	.....	12.00
Villa Grove, Colo.	.....	13.00
Warren, N. H.—cement facing (mica), per ton	.....	7.50
Wauwatosa, Wis.	.....	16.00@45.00
Wellsville, Colo.—Colorado Travertine Stone	15.00	15.00

†C.L.
*C.L. including bags; L.C.L. 14.50
‡C.L. including bags, L.C.L. 10.00.

Potash Feldspar

Auburn and Brunswick, Me.—Color, white; 98% thru 140 mesh bulk	19.00
Bath, Me.—Color, white; analysis, potash, 12%; 100% thru 180 mesh, bags, 21.00; bulk	18.00
Buckingham, Que.—Color, white; analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk	9.00
De Kalb Jct., N. Y.—Color, white; bulk (crude)	9.00
East Hartford, Conn.—Color, white, 95% through 60 mesh, bags	16.00
96% thru 150 mesh, bags	23.00
East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk	19.35
Soda feldspar, crude, bulk, per ton	22.00
Erwin, Tenn.—Color, white; analysis, 12.07% K_2O, 19.34% Al_2O_3; Na_2O, 2.92%; SiO_2, 64.76%; Fe_2O_3, .36%; 98.50% thru 200 mesh, bags, 16.90; bulk	15.50
Glen Tay Station, Ont., color, red or punk; analysis: K_2O, 12.81%, crude (bulk	6.75@ 7.00
Keystone, S. D.—Prime white, bulk (crude)	8.00
Los Angeles, Calif.—Color, white; analysis, K_2O, 10.35%; Na_2O, 3.62%; Al_2O_3, 18.71%; SiO_2, 65.48%; Fe_2O_3, .17%; 95% thru 200 mesh, bags included, carloads	22.00
Bulk	20.00
Murphsboro, Ill.—Color, snow white; analysis SiO_2, 64.4%; K_2O, 13%; Na_2O, 2.5%; Fe_2O_3, 0.07%; Al_2O_3, 19.3%; 98% thru 200 mesh, bags	21.00
Bulk	20.00
Penland, N. C.—Color, white; crude, bulk	8.00
Ground, bulk	16.50
Tenn. Mills—Color, white; analysis K_2O, 18%; Na_2O_3, 10%; 68% SiO_2; 99% thru 200 mesh; bulk	18.00
99% thru 140 mesh, bulk	16.00
Toughkenamon, Pa.—Color, white to light cream; 98% thru 150 mesh, bags, 11.00@13.00; bulk	10.00
Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude	7.50@ 8.00
Trenton, N. J.—Crude, bulk	12.00@27.00
99% thru 140 mesh; bulk	16.00
(Bags 11 cents each, non-returnable)	
Wheeling, W. Va.—Color, white; analysis,, K_2O, 9.50%; Al_2O_3, 16.70%; Na_2O, 3.50%; SiO_2, 69.50%; 99% thru 140 mesh, bulk	19.00

Blended Feldspar

(Pulverized)

Tenn. Mills—Bulk	16.00@20.00

Chicken Grits

Afton Mich. (limestone) per ton	10.00
Belfast and Rockland, Me.—(Limestone), bags, per ton	‡10.00
Brandon and Middlebury, Vt., per ton	12.00‡
Centerville, Iowa (gypsum) per ton	18.00
Chico, Texas (limestone), 100 lb. bags, per ton	8.00@ 9.00
Los Angeles Harbor (limestone), 100-lb sack, 1.00; sacks, per ton, 8.50@ 9.50†; bulk, per ton	6.00@7.00†
Toughkenamon, Pa.—(Feldspar) 100-lb. bags, 1.00; bulk, per ton	10.00
Gypsum, Ohio.—(Gypsum) per ton	10.00
Limestone, Wash. (limestone) per ton	12.50
Rocky Point, Va. (limestone) 100 lb. bags, 75c; sacks, per ton, 6.00 bulk	5.00
Seattle, Wash.—(Limestone), bulk, per ton	12.50
Warren. N. H.—(Mica) per ton	7.80
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.—(Limestone) bulk	7.50@9.00*

*L.C.L.
†Less than 5-ton lots.
‡C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Boston, Mass.	*17.00
Brighton, N. Y.	*19.75
Dayton, Ohio	12.50@13.50
Detroit, Mich.	‡13.50
Farmington, Conn.	17.00
Flint, Mich.	¶12.50@16.00
Grand Rapids, Mich.	12.00
Hartford, Conn.	*20.00
Jackson, Mich.	13.00
Lancaster, N. Y.	13.00
Madison, Wis.	†a14.00
Michigan City, Ind.	12.00
Milwaukee, Wis.	*13.00
Minneapolis and St. Paul, Minn.	11.25
New Brighton, Minn.	10.00
Pontiac, Mich.	11.00@12.00
Portage, Wis.	15.00
Prairie du Chien, Wis.	18.00@22.50
Rochester, N. Y.	19.75
Saginaw, Mich.	13.50
San Antonio, Texas	16.00
Syracuse, N. Y.	20.00
Toronto, Canada	13.00@15.60†
Toronto, Canada	13.00
Wilkinson, Fla.	10.00@12.00

*Delivered on job. †Delivered in city limits.
‡Less 5%. ¶Dealers' price. (a) Less 1.00 E.O. M. 10 days.

Portland Cement

Prices per bag and per bbl, without bags net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.	.....	3.47
Atlanta, Ga.	.....	2.35
Baltimore, Md.	.....	1.70@2.35
Birmingham, Ala.	.....	2.30
Boston, Mass.	.....	1.81@2.63‡
Buffalo, N. Y.	.....	1.67@2.38‡
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa	.....	2.34‡
Charleston, S. C.	.....	2.35
Cheyenne, Wyo.	.82¼	3.31
Cincinnati, Ohio	.....	2.37‡
Cleveland, Ohio	.....	2.29‡
Chicago, Ill.	.....	2.10‡
Columbus, Ohio	.....	2.34
Dallas, Texas	.....	2.10
Davenport, Iowa	.....	2.29‡
Dayton, Ohio	.....	2.38
Denver, Colo.	.66¼	2.65
Detroit, Mich.	.....	2.15‡
Duluth, Minn.	.....	2.09‡
Houston, Texas	.....	2.60
Indianapolis, Ind.	.....	2.29‡
Jackson, Miss.	.....	2.60
Jacksonville, Fla.	.....	2.20
Jersey City, N. J.	.....	1.85@2.33
Kansas City, Mo.	.....	2.02‡
Los Angeles, Calif.	.61†	2.44†
Louisville, Ky.	.....	2.27
Memphis, Tenn.	.....	2.60‡
Milwaukee, Wis.	.....	2.25‡
Minneapolis, Minn.	.....	2.32‡
Montreal, Que.	.....	1.36
New Orleans, La.	.....	2.20
New York, N. Y.	.....	1.77@2.25‡
Norfolk, Va.	.....	2.17
Oklahoma City, Okla.	.....	2.46‡
Omaha, Neb.	.....	2.36‡
Peoria, Ill.	.....	2.27‡
Philadelphia, Penn.	.....	1.85@2.41‡
Phoenix, Ariz.	.....	3.70
Pittsburgh, Penn.	.....	2.09‡
Portland, Colo.	.....	2.80
Portland, Ore.	.....	2.80
Reno, Nevada	.75¼	3.01
Richmond, Va.	.....	1.69@2.44
Salt Lake City, Utah	.70¼	2.81
San Francisco, Calif.	.....	2.31‡
Savannah, Ga.	.....	2.50
St. Louis, Mo.	.55	2.20‡
St. Paul, Minn.	.....	2.32‡
Seattle, Wash.	10c discount	2.65
Tampa, Fla.	.....	2.25
Toledo, Ohio	.....	2.20‡
Topeka, Kans.	.....	2.41‡
Tulsa, Okla.	.....	2.33‡
Wheeling, W. Va.	.....	2.17
Winston-Salem, N. C.	.....	2.78

NOTE—Add 40c per bbl. for bags.
†Delivered on job in any quantity, sacks extra.
‡Ten cents less to dealers.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Buffington, Ind.	.....	1.85
Chattanooga, Tenn.	.....	2.45*
Concrete, Wash.	.....	2.35
Davenport, Calif.	.....	2.05
Detroit, Mich.	.....	2.15
Hannibal, Mo.	.....	2.05
Hudson, N. Y.	.....	2.05
Leeds, Ala.	.....	1.95
Mildred, Kans.	.....	2.35
Nazareth, Penn.	.....	1.95
Northampton, Penn.	.....	1.95
Richard City, Tenn.	.....	2.05
Steelton, Minn.	.....	1.90
Toledo, Ohio	.....	2.20
Universal, Penn.	.....	1.85

*Including sacks at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ¼x32x 36". Wt. 1500 lb. Per M Sq. Ft.	—Plaster Board— ½x32x 36". Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lgths 6'-10', 1850 lb. Per M Sq. Ft.
Arden, Nev. and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u	.....	.....	.....	.....	11.70u	.....	.....	.....
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50	.....	.....	13.50	.....	.....	.....
Detroit, Mich.‡	.....	.....	.....	11.30	11.30	11.30	.....	8.00	.....	.....	.....	.....	.....
Delawanna, N. J.	.....	.....	.....	.....	.....	8.00	..... 8.25@9.40	.....	.....	.....	.14½s	.15½s	40.00@41.00
Douglas, Ariz.	.....	.....	7.00	.....	.....	15.50d	18.50	.....	30.00	15.50	.....	.....	.....
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50	.....	24.55	20.00	.....	.....	.....
Gypsum, Ohio‡	3.00	4.00	6.00	9.00	9.00	9.00	19.00	7.00	27.00	19.00	.....	15.00	30.00
Hanover, Mont.	.....	.....	.....	11.80	.....	.....	.....	.....	.....	.....	.....	.....	.....
Los Angeles, Calif.	.....	.....	10.40k	11.40k	.....	.....	.....	.....	.....	.....	.....	.....	.....
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00	.....	20.00	30.00
Portland, Colo.	.....	.....	.....	10.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Francisco, Calif.	.....	.....	.....	.....	14.40r	.....	15.40r	.....	.....	.....	.....	.....	.....
Seattle, Wash.	6.50	.....	11.00	16.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sigurd, Utah	.....	.....	.....	.....	.....	.....	.....	.....	21.50	.....	.....	.....	.....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	.....	.....	.....	.....	20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
*To 3.00; †to 11.00; ‖to 12.00; ‡prices per net ton, sacks extra; (a) to 25.00; (b) net; (c) gross; (d) hair fibre; (f) delivered; (h) delivered in six states; (i) delivered on job; (k) sacks 12c extra, rebated; (m) includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (s) per board; (t) to 16.50; (u) includes sacks; (v) F.O B. N. Y. C. and dealers yard in mill locality.

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City of shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden, N. J.	17.00	.....	.....
Columbus, Ohio	.16@.18a	.....	.....
Detroit, Mich.	.16	.....	.26
Forest Park, Ill.	18.00*	23.00*	30.00*
Grand Rapids, Mich.	.15	.....	.....
Graettinger, Iowa	.18@.20	.....	.....
Indianapolis, Ind.	.14@.16†	.....	.....
Los Angeles, Calif.¶	5¾x3½x12—55.00	7¾x3½x12—65.00	
Oak Park, Ill.	.18@.21a	.....	.....
Olivia and Mankato, Minn.	9.50b	.....	.....
Somerset, Penn.	.20@.25	.....	.....
Yakima, Wash.	20.00*	.....	.....

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton.

Cement Roofing Tile

Prices are net per sq. in carload lots, f.o.b. nearest shipping point unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.

Red	15.00
Green	18.00

Chicago, Ill.—per sq. 20.00

Cicero, Ill.—Hawthorne roofing tile, per sq.

	Chocolate Red and Orange	Yellow, Tan Green and Blue	Slate Gray
French and Spanish†	$11.50	$13.50	$12.75
Ridges (each)	.25	.35	.30
Hips	.25	.35	.30
Hip starters	.50	.60	.60
Hip terminals, 2-way	1.25	1.50	1.50
Hip terminals, 4-way	4.00	5.00	5.00
Mansard terminals	2.50	3.00	3.00
Gable finials	1.25	1.50	1.50
Gable starters	.25	.35	.30
Gable finishers	.25	.35	.30
*End bands	.25	.35	.30
*Eave closers	.06	.08	.06
*Ridge closers	.05	.06	.05

*Used only with Spanish tile.
†Price per square.

Houston, Texas.—Roofing Tile, per sq.

Red	17.00
Green	19.50

Indianapolis, Ind.—9"x15"

Gray	10.00
Red	11.00
Green	13.00

Waco, Texas: Per sq.

4x4	.60

Cement Building Tile

Cement City, Mich	Per 1000
5x4x12	40.00
5x8x12	55.00
Detroit, Mich.	Per 100
5x4x12	4.50
5x8x12	8.00
Longview, Wash. (Stone Tile)	Per 1000
4x8x12	65.00
Mt. Pleasant, N. Y.:	Per 1000
5x8x12	78.00
Grand Rapids, Mich.:	Per 1000
5x8x12	70.00
Houston, Texas:	
5x4x12 (Lightweight)	45.00
5x8x12 (Lightweight)	80.00
Pasadena, Calif.—(Stone Tile	Per 100
3½x4x12	3.00
3½x6x12	5.00
3½x8x12	6.00
Wildasin Spur, (Building Tile) Los Angeles, Calif.:	Each
4x3½x12	.03½
6x3½12	.04½
8x3½x12	.05½
Yakima, Wash.—Building tile:	
5x8x12	.10

Cement Drain Tile

Graettinger, Iowa drain tile per 100 ft.

5-in	4.50
6-in	5.60
8-in.	9.00
10-in.	12.00
12-in.	17.50
14-in.	25.00
16-in.	35.00
18-in.	45.00
20-in.	60.00
22-in.	70.00
24-in.	80.00
30-in.	100.00
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile per ft.:	
3 in.	.04
4 in.	.05
6 in.	.07½
8 in.	.10
Waukesha, Wis.—Drain tile, per ton	9.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	20.00	30.00@35.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	
Ensley, Ala. ("Slagtex")	14.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Longview, Wash.	18.00	25.00@75.00
Milwaukee, Wis.	14.00@15.00	27.00@100.00
Mt. Pleasant, N. Y.		14.00@23.00
Omaha, Neb.	18.00	30.00@40.00
Pasadena, Calif.	12.50	
Philadelphia, Penn.	15.00	20.00
Portland, Ore.	17.00	25.00@75.00
Prairie du Chien, Wis.	14.00	22.50
Rapid City, S. D.	18.00	25.00@40.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	20.00	35.00
Wauwatosa, Wis.	14.00	21.00@42.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	

†Gray. ‡Red.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.								15.00 per ton									
Graettinger, Iowa	.04½d	.05½	.08½	.12½	.17½	.....	.40	.50	.60	.70	.....	.....	.....	.....	.....	.....	.....
G'd Rapids, Mich. (b)	.....	.....	.....	.60	.72	1.00	1.28	.....	.....	1.92	2.32	3.00	4.00	5.00	6.00	.....	.....
Houston, Texas	.....	.19	.24	.43	.55½	.90	1.30	.....	†1.70	2.20	.....	.....	.....	.....	.....	.....	.....
Indianapolis, Ind. (a)	.....	.....	.....	.80	.90	1.10	1.30	.....	.....	1.70	.....	2.70	.....	.....	.....	.....	.....
Longview, Wash.							Sewer pipe 40% off list, culvert—list										
Mankato, Minn. (b)	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.50	1.75	2.50	3.25	4.25	.....	.....	.....
Olivia & Mankato, Minn.												12.00 per ton					
Paullina, Iowa‡	.....	.....	.....	.....	.....	.....	.....	2.25	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Somerset, Penn.	.....	.....	.....	.....	1.08	1.25	1.65	.....	.....	2.50	.....	3.65	4.85	7.50	8.50	.....	.....
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.80	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tiskilwa, Ill. (rein.) (a)	.....	.....	.....	.65	.75	.85	1.10	1.60	.....	1.90	.....	.....	3.40	.....	.....	.....	.....
Wahoo, Neb. (b)	.....	.....	.....	.....	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	4.62	6.14	6.96	7.78
Waukesha, Wis.								12 in. to 60 in. 18.00 per ton									
Yakima, Wash.								$10.00 per ton									

*30-in. lengths up to 27-in. diam., 48-in. lengths after; (a) 24-in. lengths; (b) Reinforced; (c) Interlocking bar reinforced.
†21-in. diam. ‡Price per 2 ft. length. (d) 5 in. diam. [1]@1.08 [2]@1.25. [3]@1.65. [4]@2.50. [5]@3.85. [6]@5.00. [7]@7.50.

Union Lime Company Sold to George A. Bowman

THE Union Lime Co., 12th street and Obispo avenue, Long Beach, Calif., which heretofore has been a branch of the Los Angeles offices, will be known henceforth as the George A. Bowman Lime Co., Inc., the entire Long Beach interests having been purchased June 14. Mr. Bowman has associated with him as stockholders Lewis C. Hanks and T. H. Wilson, who have been connected with him in the business since the first office was opened at Seventh street and Riverside drive, in 1918, from which location the plant was obliged to move to the east end of the city. It now occupies two acres, across which runs a switch off the main track of the Pacific electric railway, thereby providing service for out of town patronage.

Mr. Bowman, who is a member of many social clubs of the city, was until last week president of the Material Dealers Harbor Cities Association. He has been president of the Builders' Exchange ever since its inception, and was president of the Long Beach Credit Men's Association, of which he is now a director.

Plan to Open New Indiana Limestone Quarries

PLANS are under way for the reopening of the extensive quarry districts near Salem, Ind., and the prospects for operations on a large scale are said to be good from the preliminary surveys made. The quarries have been closed there for more than 25 years on account of the expense of stripping. For many years the stone industry was one of the leading industries of the county and also one of the most profitable.

New York operators, who are said to be working independently of the firms which made up the recent Bedford and Bloomington stone mergers, have taken options on several sites and core drillers are now at work to determine qualities of stone. Improved machinery for stripping, lessening the cost of the operation, is one consideration for the reopening of this quarry district.

The stone from the Salem quarries took first prize at the Philadelphia centennial of 1876, in the world's exhibits of building stone.

Operating Record of the South Dakota State Cement Plant

MAY was the largest month in the history of the state cement plant at Rapid City, S. D., both in the amount of cement produced and also in the amount of the product shipped, according to a statement of the management to Governor Gunderson. During the month the plant produced 64,250 bbl. of cement, the next largest month's production being in August, 1925, when 58,986 bbl. were produced. The May shipments totaled 55,486 bbl., August, 1925, being the next largest month in shipments also when 51,082 bbl. of the product was sent out.

The report shows also that while the production of the plant was the largest in its history, there was at the same time a saving made in the expenses of the plant, the cost of production being $15,925.20, while in May, 1925, the cost of operation totaled $17,868.11, a saving of $1942.91.

The report to the governor also included a comparative statement of the activities of the plant in May, 1926, and in May, 1925. This part of the report shows that the production of the cement plant in May, 1925, was 52,437¾ bbl., while the production in May, 1926, was 64,250 bbl., an increase this last month of 11,812¼ bbl. The year's production on May 31, 1925, totaled 30,792¾, while the year's production to May 31, 1926, reached 151,150 bbl. The shipments made during May, 1925, were 21,237¾ bbl., while the shipments in May, 1926, totaled 55,486 bbl. This is an increase of 34,248¼ bbl. over last year. The year's shipments on May 31, 1925, amounted to 95,928 bbl. and the present year's shipments on May 31, last, amounted to 150,729¼ bbl. This is an increase for the period this year of 54,801¼ bbl. over the corresponding period last year.

On May 31, last year, there were 41,450 bbl. of cement on hand at the plant and on May 31, this year, there were 69,334¼ bbl. of the product on hand.

The actual cash on hand from the operation of the plant on May 31 of this year was $150,509.38, while on May 31, 1925, it was $119,080.56, an increase in available cash of $31,428.82.

Foundations Placed for New Florida Cement Plant

ACCORDING to the *Tampa (Fla.) Tribune* of June 20, R. A. Drum, vice-president of the Cowham Engineering Co., Chicago, Ill., which is promoting the new Florida Portland Cement Co. on Hooker's Point, gives the reasons for his faith in the future of the cement industry in Florida as follows:

"Mr. Drum cited some interesting figures in connection with the portland cement industry, among others being the fact that two of the largest consuming groups of portland cement were as yet virtually undeveloped in Florida. The figures for the consumption of cement in the United States show that miscellaneous farm uses consumed 21% and paving and highways 24% of the cement produced last year. In this connection, the miscellaneous farm use for cement is undeveloped in Florida. With increasing agricultural development, it is natural that the consumption in this direction will increase rapidly within the next few years. Florida has expanded its road system to a remarkable degree, but a very small part of the construction has been of a permanent type, such as concrete. Those who have made a study of the road problem feel satisfied that the day is not far distant when Florida will require a more permanent and lasting type of highway construction to meet the increasing demands of heavy travel.

"Although the farm and highway use of cement in Florida is virtually nothing as compared with the rest of the United States, Florida in 1925 had the largest per capita consumption of any state in the Union. Mr. Drum said that although there might be a slight decrease in the building of certain types of dwellings and in other uses of cement, the increasing use for permanent construction of roads and farm development would offset any decrease that might be expected along other lines."

Federal Cement Awards Contracts

THE Federal Portland Cement Co., 1082 Ellicott Square building, Buffalo, N. Y., is awarding initial contracts for the construction of units for its proposed local mill to cost in excess of $2,000,000 with machinery. Awards for foundations, slurry tanks, etc., have been let to E. P. Muntz, Lehigh Valley Terminal building; for superstructure, to the Lacakawanna Steel Construction Co., Walden avenue, and for track work, to H. F. Stimm, Ellicott Square building.

Contracts Let for New Dewey Plant at Davenport

AT a recent meeting of officials of the Dewey Portland Cement Co. at Kansas City, building contracts aggregating $300,000 were placed with the Priester Construction Co. of Davenport, Iowa, for the new plant which the cement company will construct on the river road west of this city. Other contracts for machinery to equip the plant will be announced soon.

The contract awarded includes the building of the shop and warehouse building, laboratory and office building, stone storage bin, crushing plant and foundations for all buildings and machinery, slurry tanks and sewer system. The work is to start immediately and will be completed by January 1.

Big New Portland Cement Merger Rumored

THE air is full of rumors of a new big portland cement company merger. headed by the Dexter Portland Cement Co. of Nazareth, Penn. An Easton (Penn.) dispatch to *Chicago Herald and Examiner,* dated July 2, states:

"According to information received here recently from New York, a $40,000,000 cement consolidation, which involves mills in Northampton county, Pennsylvania, is about to be consummated and that it is likely final action will be taken next week at a meeting of the cement people and bankers in New York.

"Companies named in the merger are the Dexter Portland, Nazareth; Pennsylvania, of Bath; Cayuga, near Ithaca, N. Y., owned by the same interests as the Pennsylvania company; Clinchfield, of Kingsport, Tenn., and the Clinchfield No. 2 of Perry, Ga.

"Information received here is to the effect that John A. Miller of Nazareth, president of the Dexter company, will head the new consolidated company.

"The combined output of the company would be practically 10,000,000 bbl. of cement a year. The Nazareth plants of the Dexter company were recently appraised at $8,000,000."

From the *Chattanooga (Tenn.) Times* of June 29 comes the following:

"Merger of the Dixie Portland Cement Co. with seven other large southern producers was forecasted last night in well authenticated reports reaching the *Chattanooga Times.* The projected consolidation of cement interests is referred to in financial circles as one of the largest and most important that has ever taken place in the industry in the south. The transaction is said to involve interests valued at between $40,000,000 and $50,000,000, the Dixie Portland Cement Co. entering on a basis of approximately $8,000,000, or about 2.80 shares for one.

"Richard Hardy, president of the Dixie Portland Cement Co., is at the present time in New York conducting the negotiations for the local company, which were reported last night to be practically closed.

"The plant of the company is located at Richard City and has a capacity of approximately 8000 bbl. of cement daily. It is one of the most perfectly equipped cement plants in the United States, additions, improvements and betterments having been made yearly for the past decade, under the direct supervision of President Hardy, and it is largely the result of his untiring efforts that the Dixie company occupies its prominent position among the industrials of the nation.

"It is understood that the other companies involved are located in Georgia, Alabama, Kentucky and Virginia. These companies all ship into the southern territory. The merger is therefore regarded with favor in the financial world."

New Machinery and Equipment

Ball-Bearing Motors in the Rock Products Industries

By F. H. BERNHARD
Fairbanks, Morse & Co., Chicago

ELECTRIC motors are almost universally used for machinery drive in modern plants in which rock, gravel and sand are dug from the earth and converted into many useful products for the construction and other industries. Motor drive has attained rapid recognition because of its adaptability to practically all operating conditions, economy of operation and upkeep, ease of control, more constant speed and greater reliability, these last two advantages resulting in increased production.

Operating conditions for many of the motors are very severe. This is especially true of jaw-crusher motors, even when equipped with flywheels. All crushers continually suffer violent fluctuations of load and frequently heavy overloads when encountering exceptionally large or hard rock. Some motors have difficult starting conditions, calling for a starting torque two to three times full-load torque. Others are required to have a moderate range of speed control. In some cases a combination of these requirements prevails.

While a considerable percentage of the motors have to meet no extraordinary operating conditions as to load, starting, speed and reversing, a much larger percentage must contend with bad environment, particularly due to excessive moisture or dust. The motors for electric shovels, drag-line scrapers and quarry or pit pumps are liable to have imperfect protection against the weather, especially sudden showers. Unless suitably guarded, early breakdown of the insulation may result in motors subjected to exposure. In such case special insulation and impregnation for the motor windings is desirable. A special drip-proof enclosure, not necessarily sealed, however, may also be expedient.

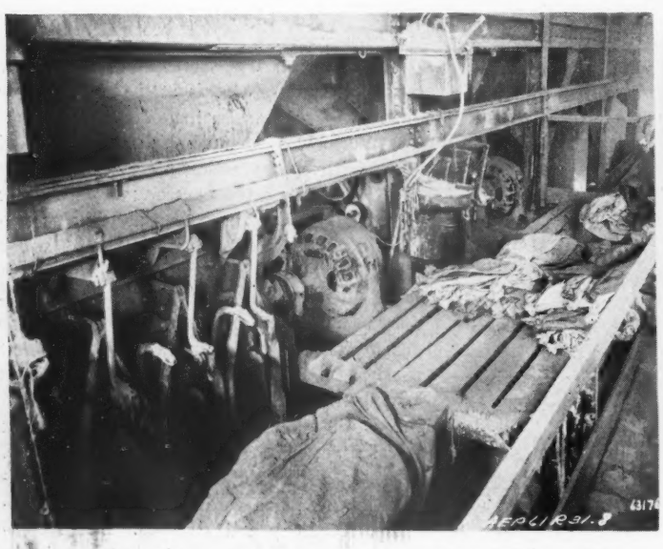
Dust is more prevalent than moisture in every one of these industries. Several kinds of dust are found in the different plants, and all are trouble-makers for motors as well as other machinery, but crushed stone is especially so because of the gritty nature of its particles, and cement dust and burnt lime are perhaps worst of all if not kept dry. The effect of dust on a motor is like a blanket in retarding its radiation of the heat developed; the machine therefore runs hot when covered with a thick layer of dust.

Aside from any possible corrosive action on the insulation of the winding, dust will lodge in and choke up slight crevices about the coils in the slots, and, being a poor conductor of heat, retard the radiation of heat from the winding. On commutators and slip rings, dust dragged under the brushes clogs up their contact surface with the commutator or slip-ring and causes heating and sparking, usually beginning at the heel of the brush. This is one of the reasons why commutator type motors are not favored where the dust is so persistent that it cannot be kept wiped off of revolving contact surfaces.

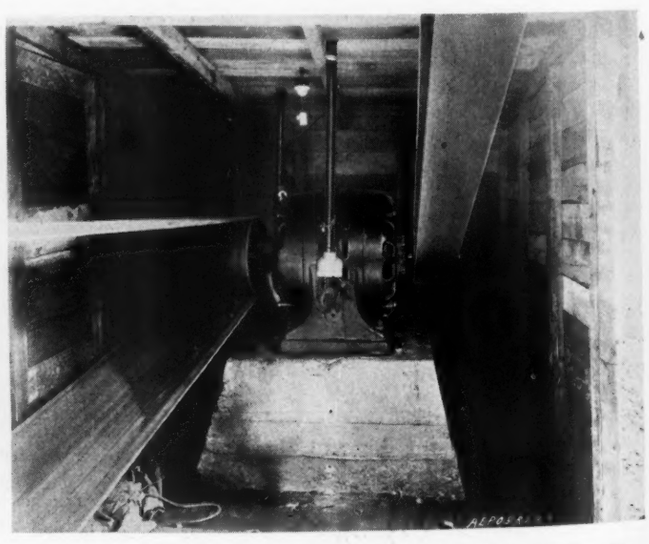
Heavy dust will work its way into ordinary oil bearings and form with the oil a sludge that is likely to slow up the action of the oil rings and be carried by the rings into the actual contact between the journal and sleeve, where it will hasten the wear of the rubbing surfaces. Unless the bearings are frequently cleaned out, they will overheat and may burn out, causing serious delay and expense.

Even under the most favorable circumstances proper lubrication and care of oil bearings is troublesome and costly. It must be done regularly at intervals ranging from a day to a month, depending on the severity of the service and surroundings. Considerable oil is spilled or otherwise wasted, and the cost of a year's supply of oil for a fair-sized motor is a considerable item. Motors that are not readily accessible are likely to receive the least attention, this neglect being a constant menace of failure that is quite sure to follow sooner or later.

Many of the operations in the plants under consideration are interdependent so that failure of a machine or its driving motor may stop the production of a large part of the plant. For example, breakdown of the motor driving the cable that hauls up the rock-filled cars from the quarry to the crusher stops the crushing, screening, classifying, conveying and storing operations because there is no material coming through. Reliability of these, and, in fact, all motor drives is therefore very important. They must withstand all starting and load conditions, bad environment and neglected upkeep. At the same time they should be of simple construction and have good power efficiency. This may at first seem like asking a great deal from a motor.

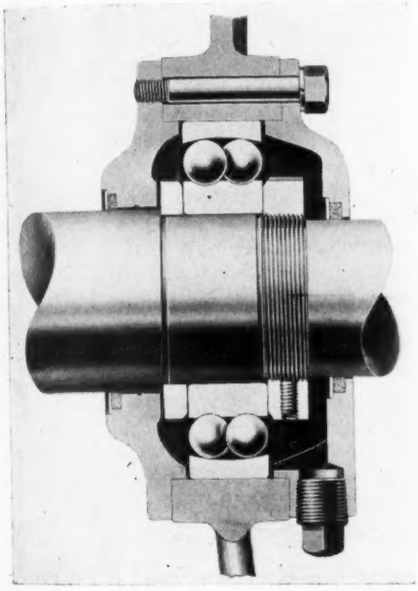


Two ball-bearing squirrel-cage motors direct connected to bag packers at plant of Riverside Portland Cement Co., Riverside, Calif.



Ball-bearing slip-ring motor of 25-hp. capacity driving No. 7 1/2 gyratory crusher at plant of Rocky Dale Stone Co., Roanoke, Va.

The ball-bearing alternating-current motors meet all these apparently conflicting requirements, as is shown by many successful installations in rock products plants. They were introduced 14 years ago by Fairbanks, Morse & Co., who have continued to give special study to their adaptation to the power needs of many industries. Just as the use of ball bearings has been highly successful on the automobile and other machines to which they have been applied, so on electric motors they have brought many advantages of which the chief ones will be discussed.



Section view of bearing housing showing self-aligning ball bearings and lubrication chamber

In ball bearings the rubbing and sliding action characteristic of sleeve bearings is replaced by rolling action, which reduces the starting and running friction to an almost negligible value. This reduces the losses in the motor and improves its efficiency. Since friction losses are always converted into heat, ball bearings run much cooler than sleeve bearings.

Lubrication of ball bearings is a very simple and inexpensive process. It is nearly always done with grease. For Fairbanks-Morse general-purpose motors, it is found that one greasing, taking about 20 minutes, suffices for an entire year. The bearing requires merely to be well cleaned with kerosene and then repacked about three-fourths full with clean grease. This last operation is facilitated by furnishing the grease in collapsible tubes containing a measured quantity of grease; the grease is squeezed from the tube directly into the bearing, thus guarding against the introduction of any dust or dirt.

The bearings are completely sealed against the entrance of dust or moisture. Motors have run continually covered with thick layers of dust, even mud, without the bearings suffering in any way. This is an important advantage for the rock products industries. Instead of being a delicate part of the motor, the ball bearing is one of its rugged features and makes it immune to adverse environment.

Likewise, the grease is sealed against escaping from the bearing. Under normal conditions it does not liquefy, but clings to the balls and races and keeps them from corroding. It cannot seep out along the shaft, as oil frequently does, to be thrown onto the windings, where it will weaken insulation.

With insignificant friction there is also inappreciable wear in ball bearings. Regardless of the direction in which the power is taken off, the air gap between the rotor and stator remains uniform. This means maintained balance between the phases, maintained initial efficiency and perfect alignment of shafts in pump and blower sets or other direct-connected units.

Another advantage is that with ball bearings it is possible to use a thicker and shorter shaft, which obviously makes a sturdier machine, one that will withstand severe shocks and vibrations in service.

It has already been intimated that direct-current motors are not favored in dust-laden surroundings because of commutation troubles. Of the alternating current types, those with commutators also are not much used. Those with slip-rings are not as troublesome, because these rings and brushes are used for leading the current into and out of the rotor without commutating it.

Consequently we find three alternating-current types in most extensive use: the squirrel-cage induction, the wound-rotor induction, and the synchronous. All these are polyphase motors and almost invariably they are three-phase machines.

The squirrel-cage type is the most used because it is the most simple and rugged and best adapted for general purposes calling for practically constant-speed drive. Its rotor is entirely self-contained and not connected with the electric supply circuit in any way. It consists of heavy copper bars imbedded in slots below the surface of the core, and each connected to massive end rings by fusion of the rings and bars, thus forming an integral short-circuited cage. The stator winding is heavily insulated. This Type H motor, as it is designated, is made in a full line of standard ratings and speeds ranging from ½ to 600 hp.

For driving machines that must be started under heavy load, but without taking excessive starting current, a special form of the squirrel-cage type is available. It has two independent squirrel cages on its rotor, each of integral construction. The outer one is of relatively high resistance while the inner one is of low resistance. In starting, the outer cage does practically all the work and gives a torque. At full speed the inner cage does nearly all the work and gives almost the same high efficiency as the single-cage type. This motor starts automatically without any centrifugal devices and requires no compensation; it requires merely a main line switch, which may be remote controlled. It is made in sizes from 5 to 50 hp. and suitable speeds.

Where still heavier loads must be frequently started with moderate starting currents and also where control of running speed from half to full speed is desirable, the wound-rotor type is used. In this the rotor has a phase winding similar to that of the stator. The rotor has connected to it through slip rings and brushes a star-connected set of external resistances and a controller for them. This type is made in standard ratings from 3 to 300 hp. These motors are suitable for driving shovels, crushers, screw conveyors, hoists and other heavy-duty machinery with widely fluctuating loads in which constancy of speed is not essential.

A Distinction in Types of Air Separators

THE Rubert M. Gay Co., Inc., New York City, state that the trade sometimes confuses the dry centrifugal with the old low velocity air separator.

The ordinary separator is an entirely different machine from the "Gayco" centrifugal, and operates on a different principle, they say. In the former the separation is made by the air as it passes through the annular space between the distributing plate and the wall of the inner chamber, and the only adjustment possible is the variation of the air velocity, either by changing the fan speed or choking the air passages.

In the centrifugal separator the material to be sized is carried up into the separating space above the distributing plate and there acted upon by centrifugal force created by means of fans which rotate the dust-laden air. The centrifugal force in the ascending column of air forces the coarser particles to the outside and gives a positive and easily controlled sizing, and this latter machine is not affected by changes in speed and rate of feed, it is claimed.

They do not recommend air separators for fine work or for installations where uniform products are required.

Motor covered with slate dust at plant of Staso Milling Co., Poultney, Vt.

New type of concrete block and brick machines

New Machines for Making Concrete Brick and Block

MACHINES for making concrete brick and block have recently been patented by A. J. Heskett and are being manufactured by the Heskett Concrete Machinery Co., 725 First St., Williamsport, Penn.

The two machines are similar in general design, hydraulically operated, and with positive acting automatic tampers. All parts of these machines are so closely interrelated and so accurately timed, according to the patent claims of the inventor, as to make them practically automatic in action. In the brick machine provision is also made for hand finishing of one side and end, if desired, after the process of tamping is completed.

Self-racking steel pallets are used with this machine, as shown in one of the illustrations, simplifying the labor of offbearing and handling in the curing room. The block machine will also make tile of a type easily handled and with load-bearing surface well distributed.

Metal Cutting with Illuminating Gas

ILLUMINATING gas to replace acetylene, hydrogen and other fuel gases in combination with oxygen for metal cutting is said to have been successfully adopted at the Schenectady plant of the General Electric Co. A special oxy-illuminating gas torch was developed for the purpose, and is now being used for the cutting of risers in the steel foundry of that plant, varying in thickness from 1 to 20 in.

As a result of tests it was found that illuminating gas is cheaper in machine cutting than either hydrogen or acetylene, while the speed of cutting after once starting is equal for all gases. The advantages of the use of illuminating gas are said to be: (1) availability; (2) elimination of delays and handling of tanks; (3) low cost; (4) safety, and chemical and physical properties permitting its use in a torch equipped with a superheater, thus affecting marked economies in the amount of oxygen required by the cutting jet.

Lyman-Richey Sand Company Buys Another Pit

THE Lyman-Richey Sand Co. of Omaha, Neb., which operates extensively in the sand pits around Fremont, has purchased the sand pit and business of Alec F. Bailey and John Monnich and have taken over that business Mr. Monnich and Mr. Bailey have been operating a sand pit south of Fremont under the name of the Bailey Sand Co.

Self-racking steel pallets for holding brick

One type of structural tile made on new machine

New Portland Cement Plant Projected in Wyoming

THAT the actual construction of the proposed cement mill a few miles from Laramie, Wyo., may be started this season seems to be more than a mere hope of Laramie citizens, in view of the recent developments and the activities of the principals concerned, says the *Laramie Republican* of June 23, which continues:

Supporting this theory are the facts that high officials of the company have made numerous visits to this city during the past 30 days and have actively engaged in inquiries concerning the availability of steel and scientific investigations of the company's property. It is also reported from reliable sources that the company has made definite inquiries concerning the availability of steel and other materials for early delivery here.

The condition of the cement market, it is understood, has received considerable study during the past few months.

The location for the proposed plant is approximately twelve miles west of Laramie, and recent acquisitions of land make the company's holdings quite large. The investigations have already necessitated the doing of considerable work on the property.

If the plant is constructed it will be necessary to build a railroad spur to the property, and such construction may in all probability precede the building of the plant, as the line will be needed to handle construction materials in addition to the daily output after manufacture is started. No data are available as to the probable cost of the plant.

It has been intimated that company officials expect to issue a formal statement of the company's intentions as soon as affairs warrant and authorization for such statement is given by the controlling officers.

Land for the new industry has been acquired in the name of the Del Mar Co. of California, an immensely wealthy corporation headed by a brother of a Union Pacific official residing in Cheyenne. Purchases of land began more than a year ago.

Another Lime Plant for Gibsonburg, Ohio

A NEW lime company, of which F. W. Zorn, C. H. Zorn, Corrine and Armetta Zorn and Fred Rutschow are incorporators, is soon to begin the building of a plant at Gibsonburg, Ohio. The company is reported to have 155 acres of land for this purpose.

The following dispatch from Gibsonburg to the Toledo *Times* gives some of the details of the new enterprise:

A new $300,000 lime plant, which will increase the present $2,000,000 lime and stone manufacture in Gibsonburg more than a half million dollars annually, will be built, it was announced recently.

The new plant which it is said will be financed entirely by Gibsonburg capital will be built on a 155-acre site at the northern outskirts of the town near the Pennsylvania railroad lines, opposite the Kelly Island Lime and Transport Co. plant. Niagara lime will be manufactured from stone, quarried on the site.

Ground for the new plant was to have been broken July 1, and the plant to be constructed entirely of steel with the most modern equipment, will be ready for operation about January 1, 1927.

The plant will have an estimated production of 37,500 tons a year in lime products and employment will be available for nearly 50 men with a payroll of nearly $100,000 a year.

Lime plants now in operation in Gibsonburg include the Kelly Island Lime and Transport Co., W. L. Urschel Lime and Stone Co., and the National Supply Co., all of which afford year-around employment.

Jacksonville, Florida, to Have Ready-Mixed Mortar and Concrete Plant

THE Central Concrete Engineering Co., Jacksonville, Fla., a newly organized firm, announces plans for the building within the next thirty to sixty days of a plant at Lackawanna and Stockton streets to facilitate the handling of cement and mortar in building and street construction. Arrangements for the plant have been going steadily forward for several months. The new company will do all the mixing of materials at a central plant.

Upon the completion of the plant, application will be made to the Southern Testing Laboratories to have a man test and certify to each batch of mixing material that leaves the plant. This will be a guarantee of only quality materials and the proper mixture, whereas at present no sure check can be made unless the contractor or person interested is on the ground as each batch is mixed.

The proposed plant will consist of two overhead loading bins of 60 yd. capacity each and one bin assembled with the plant itself, which will insure the accurate measurement of batches. Another bin will be used for dry batch deliveries. Among the other equipment is a 25-ton crane with 40-ft. boom and a ¾-yd. bucket for unloading cars as they come in. The plant will be electrically driven with the exception of the crane, which will use gas.

Many of the leading contractors have heartily endorsed the new plant and believe it will be a big saving to the builders and contractors, as well as assisting to speed up work.

The Central Concrete Engineering Co. is headed by G. C. Baker as president. Mr. Baker has had many years of experience in building and construction work. Among the other officers and directors are W. M. Mason, vice-president; J. A. Dekle, secretary; A. F. Hamby, treasurer, and R. L. Hardage, director.—*Jacksonville (Fla.) Times-Union.*

A Baffled Shaft Kiln for Lime Burning

THE EDITOR—In your issue of June 26 you report on the proceedings of the National Lime Association convention at French Lick Springs.

You state that our design for a continuous shaft type lime kiln was discussed and that: "The general consensus of opinion was that baffles could not be designed of any present known material which would stand up under lime kiln temperatures for any length of time."

We quote from a letter dated June 24, 1926, from the Calorizing Co., Pittsburgh, Pa.:

"Answering your letter of June 21, we recommend that the baffles in your continuous lime kiln be fabricated from Calite 'A,' our nickel chromium heat-enduring alloy, which satisfactorily stands continuous operating temperatures of 2000 deg. F."

Our letter of June 21 was a request for information and enclosed a print of the kiln with letter descriptive of its operating conditions.

The discussion overlooked the fact that operating conditions in our kiln make possible the use of temperatures that would be considerably lower than the extremes used in present practice. Nobody has yet disputed this claim.

When a firing door has to be constantly opened and closed for hand firing, anyone knows heat is lost and must be made up for by maintaining higher kiln temperatures than necessary to accomplish desired results. When the firing doors are opened, and you are raking your grates and putting in your fresh fire, time is lost, and the entire kiln is cooled off. With our kiln there is no lost heat or cooling off of kiln. Therefore the contention as to baffles won't hold water.

We want to hear what next the critics have to offer, and wish you would broadcast this letter in your columns of discussion.

H. MISCAMPBELL.

Duluth, Minn., June 29, 1926.

Boiler Explosion Damages Macken Granite Company Plant at Sparta, Georgia

WORK of clearing away debris at the quarries of the Macken Granite Co., Sparta, Ga., a portion of which was partially wrecked recently by the explosion of the boiler used for operating the air compressor and the crushing machine, is about completed and a crew of mechanics are now engaged in placing two large electric motors which will furnish power hereafter for the quarry. The motors will be 135 h.p. each.

W. T. Macken, owner of the plant, stated that "he hoped to get his plant back in operation on full time by July 1." The large force of stone cutters and laborers employed at the quarry has been idle since the boiler explosion which crippled the entire plant.

Blue Diamond and Eastman Merger in Los Angeles, California

THE Blue Diamond Co. of Los Angeles, producers, manufacturers and distributors of building materials, announced recently the outright purchase of the properties, stock and good will of the George L. Eastman Co., one of the largest retail building material concerns in the West.

Blue Diamond and the Eastman Co. have for many years been recognized as two of the most successful building material concerns in the United States, although distinctly different in character. The Eastman Co. developed strictly as a retail merchandising organization, while Blue Diamond became the largest concern in America engaged in a combination of production, manufacture and wholesale and retail distribution.

G. L. Eastman

The united companies will operate under the name of Blue Diamond and will engage in the retail trade in Los Angeles only. Outside of the city the company will operate strictly as manufacturers and wholesale jobbers, serving other building material companies extending over the entire Pacific coast.

The combined properties of the two companies, such as quarries, mines, railroads, manufacturing plants, real estate, stock and equipment, will total approximately $8,000,000 in assets, with an anticipated annual volume of business nearly $10,000,000.

Regarding the consolidation, W. C. Hay, president of the Blue Diamond Co., has sent to ROCK PRODUCTS the following statement:

"The Eastman Co. was not purchased merely to make Blue Diamond a larger concern, but rather to extend more quickly and completely our program of sound development. We have always held that there is no advantage in magnitude unless it effects economies, eliminates duplication and waste of effort, and makes possible a greater measure of constructive service to the public. We believe we have acquired all those advantages in purchasing the Eastman Co., at the same time becoming the largest building materials company in the world.

"Mr. Eastman's organization is a credit to his own remarkable ability. He has given generously of his time to civic work yet he built the largest building material sales organization in the country. Blue Diamond proposes to carry on the fine principles and ideals of the Eastman Co. and preserve the loyal organization that helped Mr. Eastman make it possible.

W. C. Hay

"Blue Diamond has leaned toward the production and manufacturing end of the material business. We have taken a great joy in going into the mountains and desert and developing some seemingly worthless raw material into products of quality and worth. This activity over a period of years has required millions of dollars and has been carried out with Los Angeles as the hub of the whole enterprise. There is a lot of joy in being a home industry that provides steady employment to hundreds of people the year around."

Improved Car Service Reported by Railway Association for Last Year

THE average tonnage per car of mineral products moved in 1925 by the railroads of the United States was 50.3 tons. This was an increase of 0.6 ton per car over the previous year, which in turn made a gain of exactly the same amount over 1923. The graph for the three-year period shows the most consistent progress in this industry of any of the main branches into which the car service division of the American Railway Association divides its report.

This report, which was issued the early part of last month, gives much credit to the regional advisory boards for improved conditions in freight service, and quotes a number of shippers who have been able to improve their delivery through the co-operation afforded by these boards. One stone concern had this to say:

"Our records show that more than 90% of the total cars loaded were released in less than 24 hours after being placed, and less than 10% held over 24 hours, and these practically all being handled in inter-plant switch movement, which required unloading for storage purposes."

A large quarry operator wrote to the division as follows:

"Knowing your interest in the efficient use of your equipment, I wish to call your attention to our performance during the year 1925 in the loading of freight cars at our plant. Our records show that we shipped 6920 carloads of blast furnace flux, the average loading being 68.2 tons. We shipped 4251 carloads of railroad ballast with an average loading of 69.6 tons. We shipped 6527 carloads of commercial stone other than the above, with an average loading of 62.8 tons per car.

"When you appreciate that considerable of our commercial business must be loaded in low-side gondola cars for the convenience of our patrons who do not have track unloaders, I am sure you can readily understand the co-operation we are giving you to get the most out of your equipment. This is the best record we have ever been able to make."

Favor Not Over Five Sizes of Screen Openings

AT the June meeting of the New York State Crushed Stone Association, following the discussion on standard sizes of stone which occurred at the April meeting, the committee appointed in April made the following recommendation:

"We have considered the matter of proposed standard sizes of crushed stone referred to us at the last meeting of the association and recommend that no series of standard sizes be adopted except such as can be produced by the use of screens having not to exceed a total of five sizes of screen openings."

The report was signed by W. L. Sporborg and James Savage, and after discussion by a few members was adopted unanimously.

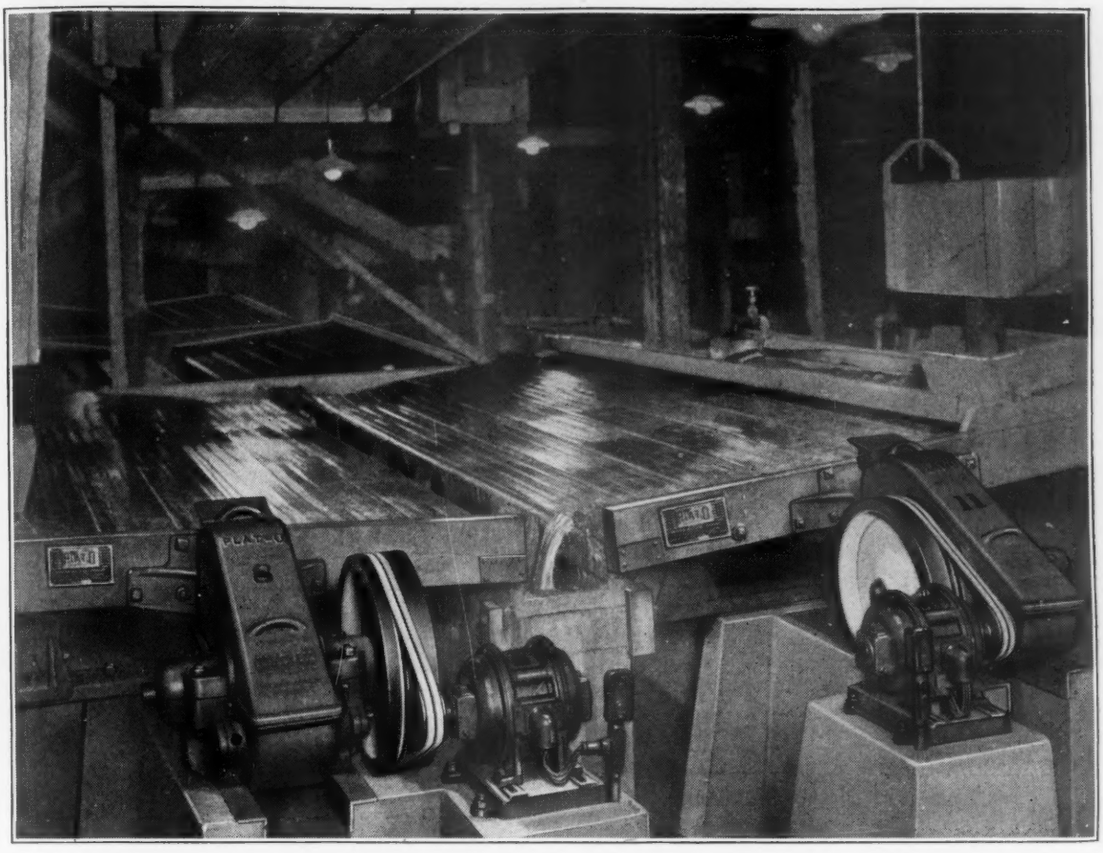
The meeting was held at the Barnes Hotel, Amsterdam, N. Y., June 25. Eighteen members were on hand when the party met in the morning for a motor trip to the plant of the Cushing Stone Co. at South Amsterdam for an inspection of the quarry and mill. J. E. Cushing of this company was host to the visitors throughout the day.

After luncheon at the Antlers Club, President Seitz called the meeting to order and the action on screen sizes noted above was taken.

In the absence of Mr. McNasser, chairman of a special committee to investigate alleged discriminations against crushed stone by a representative of the Barrett Co., it was decided to present full information to the Syracuse office of the Barrett Co. for further investigation.

The question of the adoption of an emblem for the association was taken up at this meeting. The secretary exhibited a design prepared by N. C. Rockwood of ROCK PRODUCTS. After considerable discussion it was decided that the emblem be adopted, but with the elimination of the New York state outline in the background. It was further moved and carried that the secretary procure one or more for each member, cost to be assessed against the respective individual or firm.

The July meeting of the association will be held in Utica.



Part of a large installation of TEXROPE DRIVES driving Deister Concentrating Tables at the Chino Mine of the Ray Consolidated Copper Company. Officials of this company are very well pleased with their performance.

TEXROPE DRIVES are meeting conditions in Mine, Pit, Quarry, Machine Shop, Mill and Factory, in a more than satisfactory manner.

Plant superintendents are enthusiastic about them. They like the silence, the smooth acceleration, the positive powerful grip and general all around excellence of performance. Many superintendents insist on TEXROPE DRIVES for all new, and many replacement installations.

Write for Bulletin No. 1228D

ALLIS-CHALMERS MANUFACTURING CO.
MILWAUKEE, WIS. U.S.A.

District Offices in All Principal Cities

Niles Sand and Gravel Company Expands

BETWEEN 200 and 300 acres of land recently acquired at Coyote, Calif., by the Niles Sand and Gravel Co. to take care of increased business demands will yield 200 tons of sand and crushed rock an hour when work is begun in four months, according to Nate Bishop, superintendent of the plant at Niles. Thirty men will be employed in the operations, and the acreage to be worked is sufficient to supply sand in commercial quantities for over 100 years, Bishop said.

The entrance of the Niles Sand and Gravel Co. into the field at Coyote follows upon the increased use of concrete materials in building construction and road work and the inadequacy of the holdings at Niles to fill greatly increased orders, the superintendent explained.

Thirty men are engaged at Niles in the production of 90 tons of gravel and crushed rock an hour. The Coyote fields will yield more than twice this tonnage.

A spur track to serve the plant is now being built by the Southern Pacific Co. from the vicinity of Bailey avenue and Fisher avenue to a site one mile south of Coyote. The spur will be about one and a quarter miles in length, and will be completed in about four months.

Sinking of a deep water well at the Coyote field is under way, and construction of loading bunkers, buildings for employes and a structure 200 ft. long by 18 ft. wide will be started very soon, Mr. Bishop reported.

The Bay Development Co. is operating at Coyote producing a considerable tonnage of sand and crushed rock daily.—*San Jose (Calif.) Mercury-Herald.*

Ohio Gravel Companies Contend for Columbus River Gravel

A MAJORITY of the city council of Columbus, Ohio, voted in favor of transferring the sand and gravel rights in the Scioto river from the Continental Clay Co. to the Greenville Gravel Co. of Greenville, Ohio, for a period of eight and one-half years without royalty.

The majority based their action on the contention that the river channel should be cleaned out and that the city should not repudiate its original 20-year contract made in 1914 which provided for removal of the gravel without a royalty.

Two councilmen opposed the transfer except on a royalty basis, contending that the city was overlooking an opportunity to get royalties variously estimated at from $4000 a year to $120,000 for the remaining years of the lease.

One *councilwoman* voted against the transfer of the lease because sufficient time was not allowed for its further consideration, she said.

Representatives of three sand and gravel companies and councilmen took part in the debate with charges, denials and accusations flying about.

Companies represented at the hearing were the Continental and Greenville companies and the Arrow Sand and Gravel Co., which sought the rights from the Continental company that the Greenville company acquired.

Testimony indicated the Greenville company paid the Continental company $100,000 for rights and machinery on the river on May 17, the same day on which the Continental company rejected a $12,000 offer of the Arrow company for the rights.

In turning down the royalty offers the four councilmen rejected two ordinances submitted by the Arrow company, one offering 2 cents a ton royalty and the other 3¼ cents a ton royalty for the eight and one-half years.

"No company should be allowed to touch a foot of gravel in the river without paying at least 5 cents a ton royalty, and yet council is to give the nice, kindly gentlemen of the Greenville company a present of from $100,000 to $400,000," one councilman declared.

"This ordinance might be labeled 'An ordinance to present the Greenville company with from $150,000 to $200,000,'" said another councilman.

The first claimed companies in the neighborhood of Columbus are paying as high as 10 cents a ton royalty for gravel.

Gravel company representatives declared the river bed contains from 3,500,000 to 4,000,000 tons of gravel. This can be taken out under a normal demand at the rate of from 150,000 to 200,000 tons a year, or as much as 1,000,000 tons a year, G. C. Baker, vice-president of the Greenville company, said.—*Columbus (Ohio) Citizen.*

A later newspaper report states that city council subsequently voted to reconsider its action in this case.

Would Collect for Lake Michigan Sand

JOHN BAIRD, Michigan state conservation director, was directed recently by the state conservation commission to institute a suit against the Great Lakes Sand and Gravel Co. The company has been taking sand and gravel from Lake Michigan near Bridgman, Berrien county. It recently asked for reduced rates, which the commission refused.

Now the company contends the state has no right to regulate its activities under the water of Lake Michigan. The state will seek to collect for all sand and gravel removed and to enjoin the company from operating further unless it complies with the regulations laid down by the commission.—*Holland (Mich.) Sentinel.*

New Indiana Sand and Gravel Project

THE Burr Oak gravel pits near Culver, Ind., are being opened again and if present plans of E. A. Keappler, industrial contractor of Chicago, work out, trainloads of gravel and sand will leave Burr Oak every day after September 1. About $50,000 is to be expended for equipment and buildings for the place and when finished it will be one of the most modernly conducted gravel pits.

The Burr Oak gravel pit is west of the Culver-Burr Oak road and south of the Nickel Plate railroad tracks. The Keappler company has leased one-half mile for siding track in order to keep on hand a large number of railroad cars for shipping large quantities of gravel and sand.

A crew of men is already at work cleaning the ground, tearing down the old shacks, building new tool houses and extending a railroad switch to the grounds. E. Bostrum is in charge of the building operations and is making his home in Culver.

The first thing to be made will be a large pit in the ground which will go below water level, or approximately 20 ft. deep and 60 ft. in diameter. In this hole will be placed a scow 50x32 ft. on which the pumping machinery will be erected. A 12-in. pipe will carry the gravel pumped by the machinery on the boat to a large tipple tower which will be about 70 ft. high, 30 ft. wide and 42 ft. long at the base.

In this tower the gravel will go through a series of screens in which the gravel and sand will be classified and washed. There will be four different classifications of both gravel and sand.

Extending from the tipple tower to the railroad track will be a concrete tunnel 200 ft. in length. The inside measurements will be 7 ft. high by 10 ft. wide. In this tunnel will be a loading belt which will contain 750 lin. ft. of belting 3 ft. wide.

From the top of the tipple tower and extending out over the tunnel will be a long flume 3x5 ft. which will be used for sand classification. With all this equipment and machinery the pit will be capable of loading five railroad cars of gravel or sand in an hour. One car can be loaded in 2½ minutes with the big loading belt.

Mr. Bostrum stated that his company has been contemplating the operation of this gravel pit for the past two and one-half years. It bought 57 acres of land in the vicinity of the pits about a year ago, but hesitated to make the venture. Now the company can see that it will be a good paying investment. He also stated that many tests had been made in the gravel and the supply seemed to be almost inexhaustible.—*Culver (Ind.) Citizen.*

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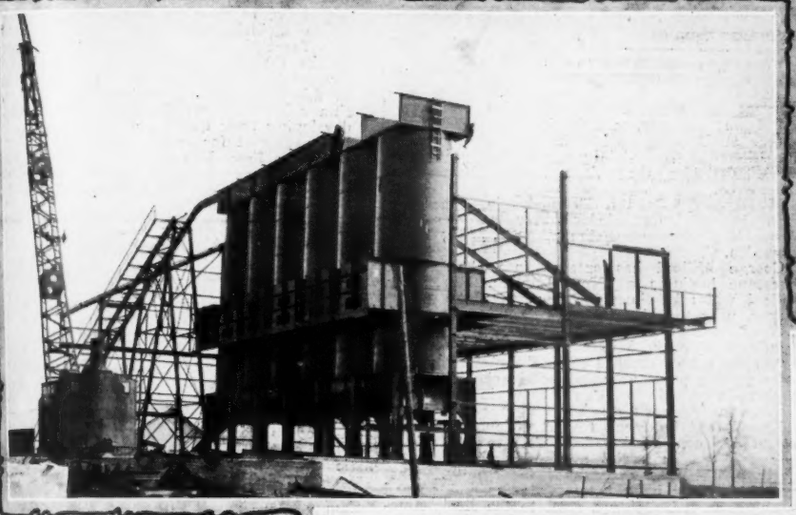

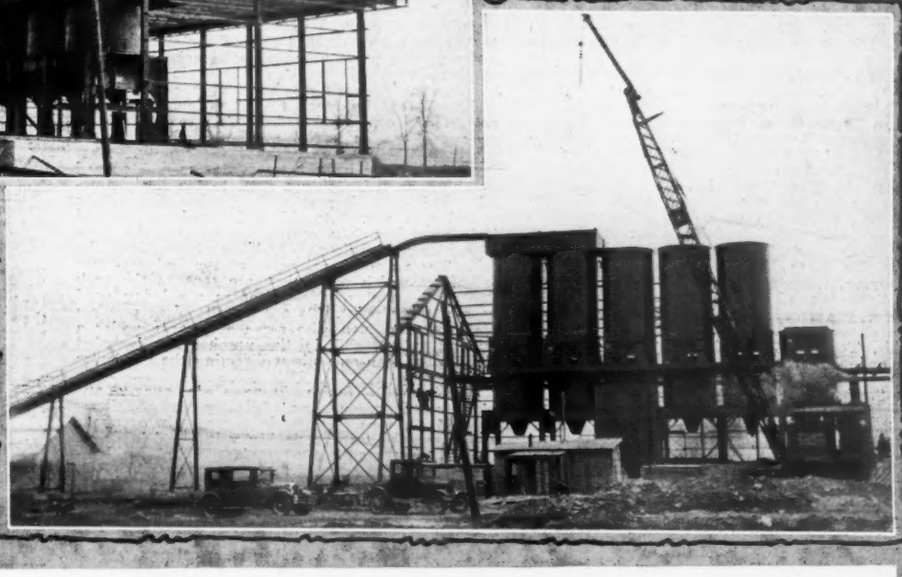

THERE are fewer lime plants in this country today than there were ten years ago. But lime production is much greater. The increased stabilization of the industry—the increased use of better-business methods by the far-seeing producers—these are things that have forced new efficiency standards upon the lime industry. And lime men who know the present trend of the industry—who realize that efficiency must be raised, and production cost lowered, if they are to "stay in the game" successfully—are turning to Arnold & Weigel Engineering Service for the benefits of Centralized Control in their new plant building projects. Centralized Control means that the responsibility for the plant's all-around efficiency is placed on one organization—with no chance for hit-or-miss results.

ARNOLD & WEIGEL
WOODVILLE, OHIO, U.S.A.

News of All the Industry

Incorporations

Kent Sand and Gravel Co., Grand Rapids, Mich., $50,000.

Federal Concrete Co., Buffalo, N. Y., increase capital from $100,000 to $150,000.

Racklestone Co., Dover, Del., $250,000; cement. (U. S. Corporation Co.)

Bennett, Whitman & Co., Detroit, Mich., $15,750. Real estate and sell gravel.

White Bridge Sand Co., Connellsville, Penn., $40,000. E. S. Fairchild, 1207 Lang Ave.

Concrete Roofing Tile Co., North Chattanooga, Tenn. E. Manuel Brody, George E. Rolland.

Cumberland Sand and Gravel Co., Wilmington, Del., $50,000. Corporation Trust Co. of America.

Chimney Rock Quarries, Inc., Greensboro, N. C., $100,000. Quarry rock, sand and gravel.

Fresh Lime Corp., Los Angeles, Calif., $100,000. George E. Slater, Walter L. Keebaugh and O. E. Darling.

Hollywood Granite Co., Los Angeles, Calif., $200,000. Adolph Buquor, Harry Mangels and H. Y. Stebbins.

Pueblo Cinder and Cement Products Co., Pueblo, Colo., $100,000. Earl E. Waters, Harold Melton, L. W. Creager.

Decker Bros. Concrete Products Co., North Bergen, N. J., $30,000. Nicholas Decker, William Decker. Cement blocks.

Arbuckle Sand and Gravel Co., Oklahoma City, Okla., $10,000. Margaret J. Thompson, J. H. Turner, Oklahoma City; C. J. Gillespie, Davis, Okla.

American Potash and Chemical Corp., Wilmington, Del., 1,000,000 shares, no par value. Organized to take over property and assets of the American Trona Corp.

Hackettstown Sand and Gravel Corp., Hackettstown, N. J., 150 shares no par value. Clay M. Whitaker, Hackettstown; Richard Townsend, Alvin Ohlsen, New York City.

Great Lakes Portland Cement Corp., Indianapolis, Ind., 60,000 shares, no par value to 80,000 shares, no par value. Building plant at Buffalo, N. Y. Adam L. Beck is president.

Brownville Slate Corp., Portland, Ore., $200,000 common, $100,000 preferred stock, par value $100. Frederick W. Hinckley, president; Frank E. Davis, treasurer; George H. Hinckley, clerk.

X-ite Corporation of America, 402 Union Ave., Memphis, Tenn., $1,500,000; manufacturing plastic or artificial stone products. Lon E. Welch, Tom O. Crosby, J. W. Harpole, L. R. Bowers and Robert S. Keebler.

Price Stone Cement Co., 645 East Tremont Ave., Bronx, New York City, 100 shares preferred, $100 par value, 100 shares common, no par value. E. and A. W. Price. Manufacture imitation stone.

Polychrome Concrete Co., Blackwood, N. J., $50,000 preferred, 3000 shares common stock, no par value. Frieda P. Gneiting, Joseph A. O'Neil, Samuel N. Astroff, Philadelphia, Penn. Attorney, Samuel P. Hagerman, Philadelphia.

Kast Stone Materials Corp., New York City, 1,000 shares preferred stock, $100 par, 3000 shares common stock, no par value. H. C. Hand, R. J. Gorman, Robert S. Ross, 150 Broadway, New York City. General quarrying and construction business.

Ross Island Sand and Gravel Co., Portland, Ore., increase in capital stock from 15,000 shares common stock, no par value, 7500 shares preferred stock, par value $100, to 50,000 shares common stock, no par value, and 7500 shares preferred stock, $100 par value.

Quarries

Linn County, Oregon, is building a rock crushing plant, according to Foreman Jake Dinkle. The plant is being erected on the banks of the Willamette river in Harrisburg. The conveying at the new plant will be done by gravity, with the exception of the first hoist. The hopper will be 60 ft. in the air, directly above the motors and crushers, which will be 20 ft. below the hopper. The pole which supports the bucket cables will be 100 ft. long.

City of Toledo, Ohio.—An ordinance providing for issuing $65,000 in bonds to purchase a stone-crushing plant and four five-ton trucks for the welfare farm, was returned to committee at the suggestion of Assistant Law Director Martin Dodd, in order that changes in its phrasing may be made.

Outagamie Stone Quarry, situated north of Black Creek, Wis., on Highway 47, is running at full capacity, according to G. L. Maas, superintendent; 12 men are employed at the present time. The company has found a new outlet for their product, it being used for tennis courts; five carloads for this purpose have been furnished and three carloads are now on order for the same purpose. Between January 15 and May 15, 6000 tons of agricultural lime have been sold, it is said.

Murphy's Quarry, Marinette, Wis., which has been shut down for some time, is getting ready to start work again. Several of the men started the first part of the week cleaning up and getting things in shape.

Big Rock Stone and Construction Co., Little Rock, Ark., are having difficulty acquiring 12 acres additional quarry property from the United States Government. The property in question is part of the Fort Roots reservation for invalid world war veterans, and the issue has been raised of the advisability of lengthening the life of the operations in that vicinity. The matter is being investigated by the Little Rock Chamber of Commerce.

Montgomery County, Pennsylvania, expects to open a convict-operated quarry and crushing plant. Maj. Romanus Fellman, Norristown, Penn., is warden.

George Millerd has entered into the crushed limestone business at New London, Wis. Mr. Millerd will take limestone from the John Kelley quarry, near the city. Mr. Millerd is a graduate of the local high school.

Jackson County, Missouri, is turning out 140 to 160 cu. yd. of crushed stone daily at its quarry and crushing plant near Independence. The plant employs from 65 to 70 prisoners in the work, operates a big rock crusher and a tarvia plant, and sends out by truck to the various road projects under construction from 140 to 165 yd. of rock and road material every day. This is the center of the road activity of the county. Last year the county bought twenty acres and opened up the quarry, building a road to the Lee's Summit road. The largest rock crusher the county owned was moved to this point and set up and is in operation. The county has adopted this plan of working the prisoners and has about 65 on the job. There are 70 prisoners at the Independence jail, from which point they are sent to the rock quarry every day. No prisoners are being used at any other point. To operate the plant requires eight salaried men who serve as guards under a superintendent, and in the number are included the powder man and others directing the particular activities.

Leathem D. Smith Stone Co.'s quarry and plant at Sturgeon Bay, Wis., recently shipped over 65,000 tons of stone in one month, or about 30% over the last year's big volume of business. In the same month a new plant record for handling stone was set when 3500 tons were handled. F. H. Behringer is plant manager and F. J. Erdman, plant foreman.

Sand and Gravel

Flesher Sand and Gravel Co., Shawneetown, Ill., has requested of the U. S. Customs office at Evansville, Ind., the privilege of changing the name of the steamer "Reliance" to the steamer "McGrath." The "Reliance" formerly belonged to W. C. Houghland and was partially destroyed by fire July 21, 1924, at Rumsey, Ky. The boat now is being rebuilt.

Auburn Sand and Gravel Co. has commenced business at Auburn Heights, Detroit, Mich. V. J. Hess, who is connected with the new company, is the son of Mr. and Mrs. George Hess, Sr., of Tell City, Ind., and formerly was engaged in the gravel business in that city.

Sand and gravel companies at Evansville, Ind., and other points along the lower Ohio river are extremely busy now and most of the fleets are operating on full time. A great deal of building is in progress in southern Indiana towns.

E. J. Lonergan, former street commissioner of Malden, Mass., has withdrawn from the Rowe Contracting Co. and started the Suburban Gravel and Sand Co. on the Newburyport turnpike at Saugus, Mass. He has purchased a gravel bank and ledge and installed a crusher and is said to have contracts with Malden and Medford for sand and other products.

France Stone Co., Toledo, Ohio, is the defendant in a suit by J. J. Heilman and M. B. Cook. The plaintiffs allege that blasts at the company quarry in Monclova township undermine their land, which adjoins the quarry property, and also shakes their buildings and showers stone upon them.

Lime

Batesville White Lime Co., Batesville, Ark., is building a spur track from their quarry, the Independence County Marble Co.'s works. This track will be about a quarter mile in length and will serve to give the marble company transportation facilities for their commercial stone and sale for their waste mill blocks. The waste mill blocks that are suitable quality will be utilized by the lime company for burning in their kilns at Limedale. It is believed that this construction will greatly help the marble company in developing their quarry, as it will not only establish a market for their waste blocks that can be used for lime burning, but will provide much needed transportation facilities and enable them to begin operations on a commercial scale.

Gypsum

Structural Gypsum Co. has moved their offices from Huntington to Charleston, W. Va.

United States Gypsum Co., Chicago, Ill., has started construction of a wharf and warehouse at Sussex St. and the Passaic River, Harrison, N. J., which will afford improved service to builders in the thirteen northeastern counties of New Jersey and Rockland County, New York. A modern concrete dock will be built, at which boats of the United States Gypsum Co. fleet will tie up with cargoes of building materials manufactured at the company's plant at New Brighton. These materials will not be retailed, but will be distributed by truck to mason's supply and lumber dealers in Newark and vicinity. Only the most modern construction and equipment will go into this new distributing depot. The warehouse will be 56x208 ft. in size, and of permanent construction. Its framework will be steel; its curtain-walls and roof will be built of structural gypsum. Cargoes will be unloaded from the barges by an electrically operated overhead traveling crane, and the same equipment will be used for loading dealers' trucks. All kinds of wall-plaster and building limes, gypsum cement, fireproof wallboard, lath and sheathing lumber, fireproof tenement tile and partition tile will be among the building materials so distributed. Among the specialties will be a factory-mixed colored stucco, plastic paint which gives texture and color-tone in one coat, patching plaster, and a plaster tinted to provide its own decoration.

Cement

Keystone Portland Cement Co., Bath, Penn., is being promoted by Fred B. Franks, former mill manager of the Bath Portland Cement Co., which was sold about a year ago to the Lehigh Portland Cement Co. Application for a charter has been made to organize a company to build a $3,000,000 wet-process cement plant near Bath, where 200 acres of land have been acquired.

The Beaver Portland Cement Co., Gold Hill, Ore., has completed improvements and additions and is now operating on three shifts per day, instead of two, as formerly.

Cement Products

Shearman Concrete Pipe Co., Knoxville, Tenn., of which H. E. Murphy is local manager, has secured a five-acre site in Venice, Fla., and will erect a concrete products plant thereon.

Stouch & Whitaker will erect a plant in Winter Haven, Fla., for the manufacture of Duntile, to be completed within ninety days, and to have a capacity of 6,000 tile per day.

P. and E. W. Harrison have engaged in business at Tacoma, Wash., as the Harrison Concrete Co.

Nelsen Concrete Culvert Co., Hattiesburg, Miss., has signed a contract with the National Stone-Tile Corp. to make "stone-tile" in Hattiesburg and surrounding territory.